REPORT

OF THE

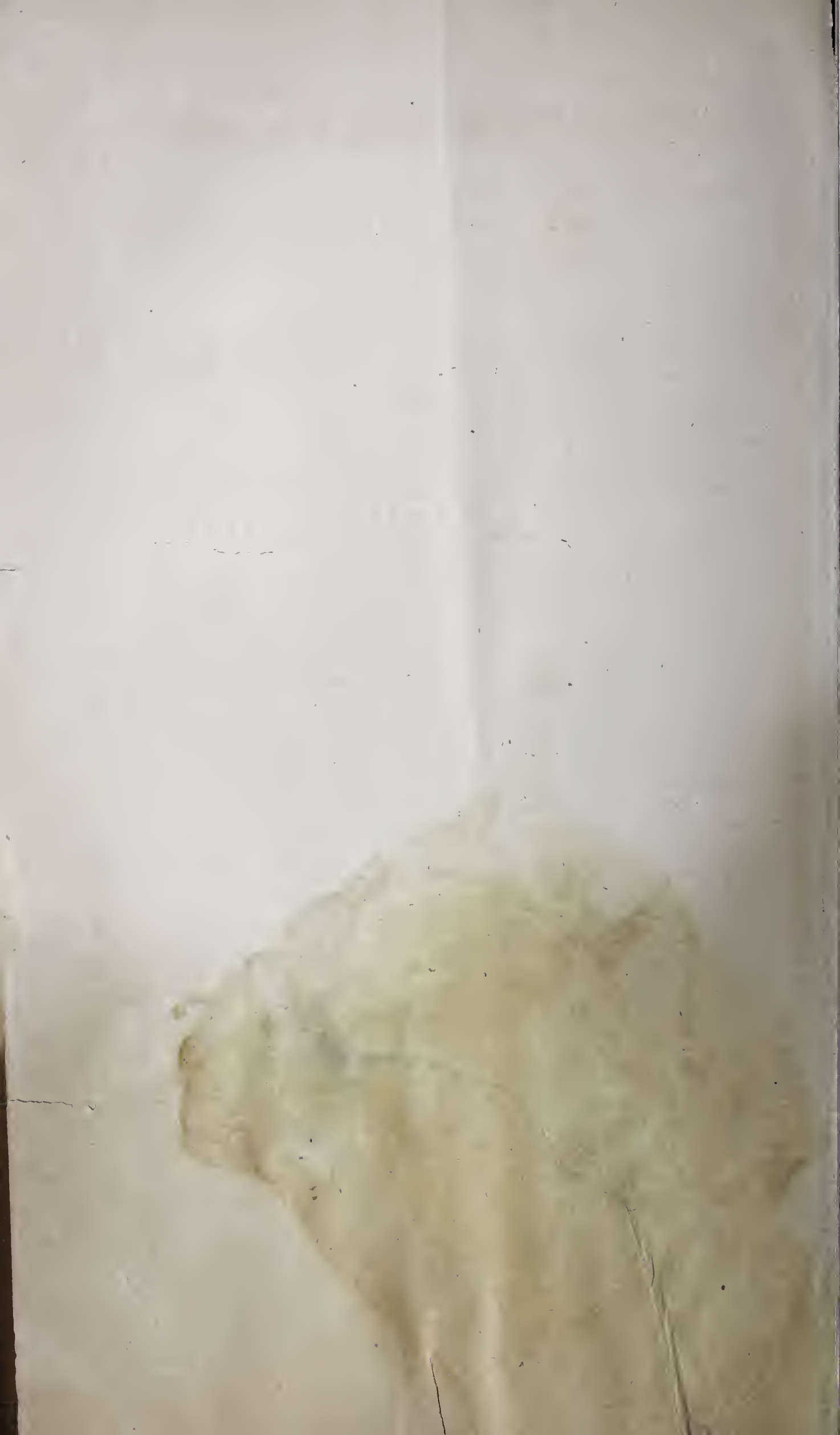
MINORITY OF THE NAVAL COMMITTEE

IN FAVOR OF ACCEPTING LEAGUE ISLAND,

In the City of Philadelphia,

FOR A STATION FOR THE CONSTRUCTION, CLEANSING AND REPAIR OF IRON AND ARMED VESSELS.

PHILADELPHIA:
COMMERCIAL LIST PRINTING OFFICE.
No. 241 Dock Street,
1864.



REPORT OF THE MINORITY OF THE NAVAL COMMITTEE

IN FAVOR OF ACCEPTING LEAGUE ISLAND, IN THE CITY OF PHILADELPHIA, FOR A STATION FOR THE CONSTRUCTION, CLEANSING, AND REPAIR OF IRON AND ARMED VESSELS.

THE undersigned, a minority of the committee on Naval Affairs, to whom was referred the following resolution, having considered the same, and the several papers submitted to them in reference thereto, and finding themselves unable to concur in the conclusions set forth in the report of the majority, beg leave to submit the following report. The resolution reads thus:

"Whereas the attention of Congress has at a previous and also at the present session been called by the Secretary of the Navy to the necessity for the establishment of new yards or naval depots for the construction of docks and repair of iron-clad vessels: Therefore, *Resolved*, That the Committee on Naval Affairs be instructed to inquire into the expediency of the establishment of such yards or depots, and to report at what site or sites such yards or depots ought to be established, with leave to report by bill or otherwise."

The foregoing resolution was undoubtedly suggested by the recommendation of the President, and the reiterated recommendations of the Secretary of the Navy, for the establishment of "a navy and dock yard" for the purposes of an iron navy, but is in its phraseology, as will be observed, more comprehensive than the recommendations of either the President or Secretary, inasmuch as it speaks of the necessity for the establishment of new yards or naval depots for the construction of docks and repair of iron-clad vessels. The language of the resolution seems to have misled the committee. That it did so will appear by an examination of the records. Thus in his last annual message the President, after having called attention to "the change that has taken place in naval vessels and naval warfare since the introduction of steam as a motive power for ships-of-war," says: "The necessity of such a navy yard so furnished at some suitable place upon the Atlantic seaboard has on repeated occasions been brought to the attention of Congress by the Navy Department, and is again presented in the report of the Secretary which accompanies this communication. I think it my duty to invite your special attention to this subject, and also to that of establishing a yard and depot for naval purposes upon one of the western rivers."

At no time has the Secretary of the Navy recommended the establishment of an additional navy yard, but, on the contrary, while expressing his willingness to execute any act of Congress for the establishment of another naval station, should it deem it necessary, has constantly excluded from all his numerous communications the idea that he deems one necessary, or that there is anything in the exigencies of the service requiring one.

On the subject of an iron yard, in a defensible position, and on fresh waters, he has been so urgent and explicit that justice requires us to present his views in his own language. His first communication to the naval committee bears date March 25th, 1862. It was followed by another on the 9th of the following June, in which he says: "It is now generally conceded that vessels for fighting purposes must be heavily

plated with iron, if they are not built entirely of that material. In this, as in most costly fabrics, economy is reached through durability. Iron ship-building is new in this country; but few persons are engaged in it, and it is a novelty in our yards. Heavy iron beams, shafting and thick iron-plates can be procured from only two or three parties, and then in limited quantities, and subject to great delay. Individuals have little use for iron of such magnitude as the navy must have, and there must unavoidably be great outlay to prepare for the execution of such work. With only the navy for a purchaser there can be no competition, and the government will be compelled, under such circumstances, to pay almost any price the mills and forges may demand. No inconsiderable portions of an iron ship can be made and procured at the ordinary mills, and so far as it can be done, it may be the best policy to be so supplied; but as the heavy and expensive portions cannot be so procured, and unless the government is prepared to execute the work, it will be subject to imposition and its vessels to marked inferiority.

"Other nations, whose wooden ships-of-war far exceed our own in number, cannot afford to lay them aside, but are compelled to plate them with iron at a very great cost. They are not unaware of the disadvantage of this proceeding, but it is a present necessity. It must be borne in mind, however, that those governments which are striving for naval supremacy are sparing no expense to strengthen themselves by building iron vessels; and already their dock yards are undergoing the necessary preparation for this change in naval architecture, notwithstanding those governments have at their command the greatest experience and the most extensive and complete iron and machine factories that private enterprise can produce. These facts are suggestive to our government; and I desire to call your attention to the necessity of making the necessary provision for ourselves, by providing the means and conveniences for building and repairing a navy, such as the strength and character of our government and country require, in order to maintain its true position among maritime powers.

"We have been engaged for years, and have spent millions in our navy yards, and on our steam machine shops, for ship-building purposes, and yet have not been able to keep up with the wants of the navy and the exigencies of the service.

"It is not the part of wisdom to close our eyes to the progress of events, nor to evade the responsibilities that properly belong to us. The creation of a new and different navy, such as the development of science and art already demonstrate as a necessity, calls for vigorous measures and prompt and energetic action. The government should not, in justice to itself, be dependent on private establishments for its important and expensive works, but should rely upon itself. Great works, however, require time in their preparation, and lavish expenditures cannot hasten them. Congress has been liberal in its appropriations for building vessels, but these appropriations cannot be made available in obtaining the proper locations, and mills, forges, furnaces, and shops, all of which are requisite, and which, to be secured properly, need time and careful consideration.

"If the money for these purposes be now appropriated, we shall commence, under as favorable circumstances as any nation, the construction of a navy adapted to the wants of the country and the times.

"No nation can have an advantage over us, if we avail ourselves of our means and opportunities, and it is no longer doubtful that our future safety and welfare are dependent on our naval strength and efficiency. It is a duty, as well as a necessity, that we make these United States a great naval power. We owe it to ourselves to commence at once this

work, and the present Congress should, in my opinion, take the preliminary steps at the present session for laying the foundation for the construction of a navy commensurate with the wants and magnitude of the country. The place or places, the shops and tools, and other appurtenances for this great work, must be provided in season. The experience we have had admonishes us not to permit a war to come upon us unprepared; yet such an event may be pending, and the responsibility and calamities that would follow neglect should be a warning to us to be prepared. No amount of money would repair the wrong that might be inflicted from present neglect. A million or two of dollars, judiciously expended at the present time, may save hundreds of millions, and the honor of the nation, after hostilities shall have commenced."

In his annual report, December 1, 1862, the Secretary renews his suggestions, and says:

"In March last, and again in June, I invited the attention of the naval committees of Congress to the importance of taking prompt preliminary measures for establishing a navy yard, including foundries, shops, and docks, adapted to the growing wants of the service and the country. It was *not that we needed an additional navy yard*, but that we required one of a different character, in many respects from any that we possess.

"In view of the importance of possessing, somewhere in this country, a navy and dock yard for the purposes of an iron navy, the suggestions of the department received the favorable consideration of Congress. The city of Philadelphia, the commercial centre of the iron and coal regions, became interested in the question, and was induced to made a free offer of League Island, a body of land of about six hundred acres near the confluence of the Delaware and Schuylkill rivers, to the United States for naval purposes. In consequence of this liberal offer, Congress authorized the Secretary of the Navy to receive and accept League Island: provided, however, that it should not be accepted until the title shall be perfect to low-water mark, nor if, upon a more thorough examination and survey of the premises by a competent board of officers, to be appointed by the Secretary of the Navy, he shall discover that the public interest will not be promoted by acquiring the title as aforesaid; that the board to be appointed shall, before proceeding to any decision of the questions referred to them, make a survey and examination of the harbor of New London, in Connecticut, and its surroundings, with reference to its fitness for a naval depot and navy-yard; and that they also make the same investigation in regard to the waters of Narraganset Bay.

"Pursuant to the requirements of the act of Congress above referred to, I appointed on the 12th of August, a board of officers, consisting of Rear-Admiral Stringham, Commodores Van Brunt and Gardner, and Captain Marston, of the navy, Professor Bache and Engineer Sanger, to make the required examination, and report. The board was assiduously engaged for over two months upon the duty assigned it, and after completing the survey and examination, revised their labor; and, upon a full discussion of the subject, the members unanimously rejected any proposition for the contemplated navy yard on the waters of Narraganset Bay. In regard to the two other locations, League Island and New London, and which is best adapted to the purposes of such a navy yard and depot as is contemplated by the law, the board is divided in opinion, and presented majority and minority reports. The majority, comprising four members, award to New London the preference over League Island for a navy yard. The minority as fully and emphatically give their preference to League Island, as possessing important requisites which the other does not, and as being better adapted to the special

wants of the government and the objects of the law authorizing the appointment of the commission.

"Without attempting, in this place, to analyse these voluminous reports, or to reproduce the arguments adduced by each, I have considered it my duty to bring the subject to the attention of Congress, and to reiterate my opinion in favor of a new yard and depot better adapted to the construction of iron vessels and iron-clad vessels than any we now have, and where this description of vessels may be repaired, or, in time of peace, laid up in ordinary. In selecting a site for such a navy yard, there are two essential and controlling considerations that must govern. One is the very great advantage (if not absolute necessity) of fresh water over salt water for the preservation of iron vessels. The other is, security from an attack by a foreign enemy. These two primary qualities are to be had at League Island. Iron and coal are also in close proximary to that location.

"New London has a commodious harbor, and were it less exposed, some good qualities for a navy yard, provided it be the intention of Congress to establish another similar to those we now have for the construction of wooden vessels. For an iron navy, and for iron purposes, I am not aware that it has any advantages over Brooklyn, or Charlestown, or Portsmouth; and if not, Congress must determine whether another such yard shall be established. The department has not suggested or contemplated the acquisition of a yard and depot of that description, but called attention to the growing necessity of an establishment for an iron navy. The law, while requiring an examination of other places by a board, authorizes no action by the department for the acceptance of any other than League Island, and I do not, therefore, propose to canvass the merits or demerits of New London or Narraganset Bay.

"League Island has the requisite of fresh water, which is indispensable for an iron navy yard; and is remote from the sea, which renders it a place sf security. The objections to it are its low alluvial soil, the cost of raising it to a proper grade, the depth it will be necessary to penetrate before reaching safe bottom, and the expense of piling, on which to erect superstructures. These are weighty objections, and it will require no inconsiderable expenditure to overcome them. In addition to those above enumerated, is the fact that the navigation of the Delaware river is sometimes obstructed by ice, and injury is sometimes caused by floating ice; but there is no river east or north of it where the objection is not much greater.

"In regard to the location of naval depots, and the necessity of having them secure from foreign enemies, I cannot more distinctly and clearly present what are the requisites than by quoting from the report of a very able board of eminent officers and engineers on the sea-coast defences, made in 1820:

"'Security against an attack by sea or land is undoubtedby the first condition required; for the destruction of an establishment of this nature involves with it the destruction of all those elements of a naval force which have been collected a long time beforehand, and during peace, to the incalculable loss of the public. Such a misfortune must be severely felt during the whole course of a war, and cannot well be repaired while it continues. This indispensable quality (security) must be obtained, as well as localities will admit, without having recourse to artificial fortifications; for these must be very costly, and if that expense can be avoided, the same sums will be much more advantageously laid out in improving and aggrandizing the establishment of the depot. Thus, if equal in other respects, a place whose site is naturally strong,

and whose position with respect to the general frontier is well covered, should be preferred to another that requires to be fortified."

"The great essential here specified, of security from attack by a foreign enemy, appertains to League Island, which has, in that respect, strong topographical advantages. Its interior location might have constituted an objection at a former period, when only sailing vessels were in the naval service; but the introduction of steam has wrought a revolution in this respect, rendering the movements of our war-vessels independent of wind and tide. Immediate contiguity to the ocean is no longer deemed an advantage, but a disadvantage. Steam, rifled cannon, and modern improvement in ordnance, have rendered harbors and depots immediately on the seaboard insecure. In a recent debate in the British Parliament, it was emphatically urged that Portsmouth and its immense and costly works must be abandoned, for the reason that a naval depot should not be within the range of five or six miles of an attacking force. If, then, fresh water be indispensable for a navy yard for the construction, repair and dockage of iron vessels and vessels that are clad with iron, there is no position east of the Delaware where the difficulties from ice do not exceed those urged against League Island, nor has any place been proposed that presents equal advantages, or is so secure from an attack. While there are some obvious and admitted objections to League Island, no place has been proposed that combines so many advantages, unless it be the contracted and altogether inadequate yard at Philadelphia. That yard may perhaps be extended so as to double its present capacity, but besides involving a large expenditure, it would be then insufficient for our future iron navy.

"The occupation of League Island would not increase the number of navy yards that we now have, for, when once in operation, the discontinuance of the present site at Philadelphia would take place as a matter of course, and the avails could be, and doubtless would be, diverted to the improvement of the new location; whereas, the adoption of any other site would be the addition of another navy yard similar in character to those we now have, which is not required.

"The conflicting reports, and the conditions annexed to the law authorizing the Secretary of the Navy to receive and accept League island, have occasioned embarrassment, and I have therefore deemed it respectful to delay action until Congress should convene. As neither the harbor of New London nor the waters of the Narranganset bay are adapted to the purposes and wants of an iron navy, whatever may be their advantage in other respects, and as League island has the requisites of fresh water, security from external enemies, and proximity to iron and coal, I propose to receive and accept for the government the munificent donation of the city of Philadelphia, unless Congess shall otherwise direct."

And in his last annual report the Secretary renews and enforces his suggestions as follows:

"In consequence of the omission of Congress to take any action on the subject of enlarging the present circumscribed navy yard at Philadelphia, or to signify its acceptance or rejection of League island, tendered to the government for naval purposes by the city of Philadelphia, or in conformity with my suggestions to initiate means for establishing a suitable yard, workshops, and docks for an iron navy, and the machinery and armature which modern improvements render necessary, no progress has been possible during the year on that important subject. The government is destitute of a suitable establishment for the construction or repair of iron vessels, their machinery or armature, nor has it any place for preserving them when laid up in ordinary. Some proper and

suitable accommodations for vessels of this description are necessary where there is fresh water, and, as stated in my communications to the last Congress, it has appeared to me that no place combines so many advantages as are to be found on the Delaware, in the vicinity of Philadelphia. A commission of naval and scientific gentlemen was appointed under authority of Congress to examine League Island and also to "make a survey and examination of the harbors of New London, Connecticut, and its surroundings, with reference to its capacity and fitness for a naval depot and navy yard, and whether the public interest will not be promoted by establishing a naval depot or navy yard in or near said harbor of New London, instead of League Island, and that they also make the same investigation in regard to the waters of the Narraganset bay." The majority of this board recommended the establishment of an additional navy yard at New London. On that subject it is unnecessary that the department should express an opinion. It is a question for Congress, which instituted the inquiry, to decide whether an additional navy yard on the old plan is wanted at New London, and should it be in the affirmative, it will be the duty of this department to carry that decision, when made, into effect.

"But aside from and independent of the question of an additional navy yard, is that of more extended accommodations and more ample facilities on the Delaware than we now have in the narrow and wholly insufficient limits of the navy yard at Philadelphia Those limits, as stated by the chief of the Bureau of Yards and Docks in his able and practical report, can be enlarged to about double the present area by purchase at an expense of about $300,000; but with that addition the yard would still be wholly inadequate to the public necessities, and too small for such an extensive establishment as the wants of the government require. It would undoubtedly be the part of wisdom and true economy to procure ground with ample water front for such an establishment as the increasing public wants demand, in the vicinity of Philadelphia, and, so soon as it can be made available, to dispose of the present grounds, and apply the proceeds towards improving the new location.

"The chief of the Bureau of Yards and Docks, whose experience and judgment entitle his opinions to consideration, suggests another locality than League Island, at Marcus Hook, a few miles below Philadelphia, on the right bank of the Delaware, which he supposes may, perhaps, be obtained at a reasonable rate. From the examination which I have been enabled to give this subject, I am not prepared to say that the advantages are, to my mind, such as to counterbalance those attainable at League Island, which has been tendered to the government for its acceptance, nor is there assurance that land near Marcus Hook can be procured at any price. Either place, however, might, I apprehend, be satisfactory, and, as I have already stated to Congress, there is no doubt that for the purposes of a navy yard, and establishment for an iron navy and its wants, the banks of the Delaware present advantages that are not to be found elsewhere in the United States. Prompt and judicious action by the legislative branch of the government upon this subject is, in my judgment, urgently needed, and will, when it shall have been had, be carried into effect by this department with all possible activity."

From the foregoing, it is apparent that the President and Secretary regard a station for the repair and construction of iron and armored vessels as an essential want of the government, and, for such a station, the undersigned believe New London to possess none of the essential qualities.

For a yard for the construction, docking and repair of iron vessels, fresh water is absolutely necessary. This our own brief experience in

the use of such vessels would seem to have demonstrated, but we may appeal to science and the experience of foreign navies in support of the fact. The British and French governments have bestowed much attention on the question, and the reports of the transactions of the British Association for the Advancement of Science contain several papers embodying the results of an immense number of experiments, and the deductions of the ablest scientific minds of the world therefrom. They all demonstrate the destructive influence of salt water upon iron vessels, and the prejudicial influence of the atmosphere prevailing on the sea-coast on the machinery for the construction of these vessels and the material while in process of construction.

Before referring more specifically to these papers, the undersigned beg leave to present the following memoranda furnished by Rear Admiral C. H. Davis, and to remark that the results disclosed in the several papers alluded to fully sustain the accuracy of the results he presents.

"Plates of common boiler iron exposed for the same length of time to salt and fresh water, and to the atmosphere, were encrusted in the following proportions:

Fresh water	1.00
Clear sea-water	7.07
Foul sea-water	14.00
Weather	10.70"

That they may not extend this report to an undue length, the undersigned will content themselves with referring for abundant coroboration of the accuracy of these results to the following several papers, namely:

The first report upon experiments, instituted at the request of the British association, upon the action of sea and river water, whether clear or foul, and at various temperatures, upon cast and wrought iron, by Robert Mallet, M. R. I. A. Ass. Ins. C. E.

Volume VII, 8th report of the British Association for the advancement of Science, 1838, pp. 253–312.

The second report upon the action of air and water, whether fresh or salt, clear or foul, and at various temperatures, upon cast iron, wrought iron, and steel, also by Mr. Mallet.

Report of the British Association for the Advancement of Science, for 1840, pages 241–308.

The report made on the same subject by the same gentleman in the transactions of the association for 1843, pages from 1 to 53.

And a further report to be found in the volume for 1849, pages 88–112.

The experiments, the results of which are recorded in these papers, establish beyond controversy all the facts set forth in the memoranda furnished by Rear-Admiral Davis, and prove that the influence of the weather alone upon the seashore is more than ten times as deleterious to the exposed surface of iron as that of fresh water.

From the report to be found in the volume for 1843, page 27, we beg leave to submit the following:

"Were it the fact, therefore, that unprotected iron vessels corroded equally throughout every part immersed, we could easily calculate, by the aid of our preceding researches, the durability of a ship of given scantling, and predetermine, under such and such conditions, at what time her hull would have become dangerously thin, and might rest with the assurance that for this period the iron ship was the best and safest that could be put upon the waters; but, unfortunately, we have found that corrosion does not ake tplace with perfect uniformity, as has been already pointed out and hence, without protection, ships of iron must be always liable to the dangerous consequences of local corrosion, and consequent thinning down of iron at particular spots, until at some unforeseen moment, possibly of least preparation and greatest external peril, a

decayed plate is burst through, and the vessel fills. The facility of introduction of water-tight bulkheads in iron ships greatly reduces the danger of such an accident, but it must always be attended with danger and loss of property, and occurring where it is most likely to happen, namely, in the engine compartment of an iron steamer in bad weather, would be almost certain to involve the loss of the ship."

"The more sanguine advocates of iron ship-building have, in their anxiety to prove their durability to be such as to render protection needless, appealed to the existence of iron canal-boats of forty years of age or more, and to some of the earliest built iron vessels which have been occasionally in salt water. Most of the vessels alluded to, however, have been principally in fresh water, and on referring to table XV, it will be obvious how vast a difference there is in the durability of a ship of any given sort of iron, exposed to the action of sea and of fresh water. Thus, suppose a vessel of Low Moor plates, in one century the depth of corrosion would be—

In clear sea- water	0.215
In foul sea-water	0.404
In clear fresh water only	0.035

"In other words, while the ship, if originally of half-inch plates, would be almost destroyed in foul sea-water, it would not have lost one-tenth of its scantling in clear fresh water in the same time. These cases therefore prove nothing to the point.

"It therefore seems to me that protection against local corrosion and 'fouling' are essential to the safety and perfection of iron ships, and are alone wanting to render our future iron ships as much safer and more enduring than those of timber, as the steamship of to-day is safer and more enduring than the sailing vessel of two centuries ago."

Though at the time that report was made—1843—it was confidently believed that the means of protecting iron vessels against corrosion and fouling had been discovered, experience has demonstrated the hopeless inefficiency of every method yet suggested.

From this it appears that the detrimental influence of salt water acts not upon the external surface of the vessel alone; and upon page 15 of the report from which we have just quoted in paragraph 331, we find that—

"The lower part of an iron ship's floor is exposed to putrid bilge-water. This, on grounds already stated, is a great corrosive power, and when heated, as beneath the boilers in steam vessels, its effects are greatly increased, as far as action from the inside is concerned; therefore the floor and futtocks may be expected soonest to require restoration."

But more important, perhaps, than the corroding influence of salt water is the "fouling" in such water, of the bottom of iron vessels, by the collection upon them of *balanus*, *otion*, *ascidia*, *cineras*, *anatifida*, *ostrea*, *mytilus*, *dreissenna*, and other barnacles. To such an extent do these accumulate upon the bottoms of iron vessels in salt water, that in a cruise of three months in our warm latitudes they will reduce the speed of a steamer from 20 to 33 per cent. It is recorded that when the British iron ship Ben Ledi returned after a cruise, ten tons of muscles and barnacles were removed from her bottom. For this evil, which, while so largely diminishing the speed, materially increases the consumption of fuel by our vessels, fresh water is the only remedy that has yet been devised. Indeed no other perfect remedy is now hoped for by scientific men. In the report of 1843 to the British association, it is said:

"The mechanical methods which have been proposed for removing foulness from the bottoms of iron ships, namely, by scraping with a large wooden frame drawn under the hull by suitable rope tackle, appear quite

incapable of removing more than the exterior fringe, as it were, of the 'foulness,' or some of the larger animals, when once become adherent. The force with which both animals and plants adhere to the coat of calcareous and rusty matter on an iron plate is very great, and no instrument sufficiently sharp, and pressed hard enough to the ship's hull could probably be successfully used, unless of iron, and this would be liable not only to injure the surface, but become constantly caught against small projections of the ship's bottom."

In a note of February 3, 1864, Professor Spencer F. Baird, of the Smithsonian Institute, says:

"Although not specially conversant with the natural history of the marine invertebrates, I think I can safely say that there are no fresh-water analogue of the barnacles, &c., that infest ships' bottoms at sea, or at least none of a parasitic and sessile character, at all likely to affect the vessel's condition. The species most troublesome in this respect are the barnacles, oysters, mussels, (snytile,) and perhaps some algæ. All these would die in fresh water, and would in considerable part drop off. At any rate, there would be no fresh growth of the same animalcules, nor of anything else at all similar."

All experience confirms this theory; and we are officially informed that the iron gunboat South Carolina arrived at Boston from the blockade, and when docked, the immense accumulation of barnacles that had impaired her speed had to be pried off with crowbars, to the serious detriment of the surface of the iron; and that, on the other hand, the first of our monitors arrived at the Washington navy yard, and after lying one week in the fresh water of the Potomac, was hauled out, and all the foul matter that had accumulated upon her was easily removed by the use of a common shovel.

New London is a seaboard city, lying two miles and five-eighths from the point at which the waters of the Thames enter into Long Island sound, and eight and three-eighths miles from the open sea. Its water is as salt as that of the ocean. Its exposed situation on the seaboard prevented its adoption as a naval station in the early history of our country. On the twenty-ninth of January, A. D. 1800, Joshua Humphreys was ordered by the Navy Department to examine and report upon the fitness for naval stations of the several ports of New London, Newport, Providence, Boston, Charlestown, Portsmouth, Portland, and Wiscasset. After setting forth the advantages of New London, he noted the following disadvantages, which were deemed conclusive, and led to its rejection:

"First. The harbor below Winthrop's Point is not sufficiently large for such a navy as the United States must have, and above this point the river is frequently full of ice, the breaking up of which makes it dangerous to vessels to lay in it.

"Second. The impossibility of entering this port with a northwest wind, which is the most prevailing wind in the winter season.

"Third. Vessels in this port are subject to be injured by ice in the winter, if they lie in the channel. To deepen the basin sufficient to move vessels inside of the dock to keep them clear of ice, would cost a considerable sum, and be an annual expense to keep it sufficiently deep.

"Fourth. The harbor is very open and exposed all below Winthrop's Point.

"Fifth. An enemy, with the wind at east or west, has a leading wind up to Winthrop's Point and down, which is a great advantage in the attack by water of any place.

"Sixth. Rise of tide being only three feet.

"Seventh. The commanding heighths to westward of Fort Trumbull.

"Eighth. Probability of worms."

A position that was thus indefensible against the naval armaments of nearly three-quarters of a century ago by reason of its close proximity to the sea, is certainly not one that a wise nation would select as the site for an extensive and important station for the construction of iron ships and machinery if it could obtain one on fresh water, and in a defensible position.

The site of the proposed navy yard at Winthrop's Point is surrounded on two sides by salt water, and iron vessels constructed there would suffer while in the process of construction, and would, when fitted out, require to be removed to a fresh-water station to cleanse their bottoms, if expected to go to sea capable of operating with any measure of speed proportioned to the sail they might carry, or the amount of coal they would consume.

The majority of the committee have not entirely ignored the importance of this question, but have sought, as appears by their report, to escape its consequences by accepting the reiterated assertion of interested parties, that the water of the Thames opposite Winthrop's Point is merely brackish. Let who may assert or believe this, it cannot be true; and were the truth not demonstrable, it would be a subject of regret that the committee had not taken testimony on the point. The laws of nature are general and inflexible. They operate in the vicinity of New London as they do elsewhere; and if it be true that a light fluid must always yield to one of greater specific gravity, and that a larger and weightier mass of fluid must control a smaller one of less density, the waters of the Thames must be forced back for a long distance from its mouth by the superior gravity and volume of those of the sound at a point but five and three-quarter miles from its entrance into the ocean. Sea water, as every mariner or merchant who has freighted a ship to traverse both salt and fresh water knows, is heavier than fresh water, and there is no small disparity between the surging tide of the Atlantic ocean sweeping into the mouth of the sound and the waters of the Thames finding their way to the sound. It requires no small measure of credulity to believe that the waters of the Thames at New London are only brackish. It is not, however, impossible that, in certain conditions of the wind and tide, the surface of the river may be less salt than it is under other conditions. This is a phenomenon often remarked at points within thirty miles of the mouth of tidal streams. Thus the mouth of the Liffy, at its confluence with the Poddle river, is salt at full tide upon the surface, though at low tide it is fresh, but the under-current is always salt.

In the report of Mr. Mallet to the British Association, to be found in the transactions for 1840, (page 227,) he says: "I would here remark a cause of increased corrosive action affecting castings, such as cast-iron piling, &c., at the mouths of tidal rivers, which has not to my knowledge struck previous observers. It is well known that the sea water during the flowing of the tide, from its greater density, forces itself beneath the river water like a wedge, and slowly and imperfectly mixes with it; hence two strata, one of fresh or brackish water, the other of salt water below it. Thus, while engaged in a diving-bell survey of part of the bed of the river Bann, in the north of Ireland, last year, I found during the flow of tide, the water strongly saline at the bottom of the river, and yet fresh enough to drink within three feet of the surface, the total depth of water being about twenty-five feet; and in the proceedings of the Royal Society of Edinburgh (April, 1817) will be found a paper by Mr. Stevenson, C. E., in which he describes analogous phenomena as occurring at the mouth of the river Dee, at Aberdeen, in the river Forth and Tay,

and at Loch Eil, where the Caledonian canal joins the western sea." On taking up water at various depths at Fort William he found the specific gravity—

At the surface	1008.2
At 9 fathoms	1025.5
At 30 fathoms	1027.2

or completely fresh at the top, and salt as the sea itself beneath.

Now, Becquerd has proved that a homogeneous metallic surface, (a rod or line for instance,) exposed to the action of a fluid menstrum, will assume a state of electrical tension, provided that the fluid in which it is immersed be of different density in two strata, *i. e.*, of different corrosive power.

In fact, the metal and the two layers of fluid constitute a voltaic pile of one solid and two fluid elements; hence, as one end of the metallic rod will be in a positive state with respect to the other, it will be corroded faster than the other.

Now, this is precisely the condition of any casting reaching through a considerable depth of water at the mouth of a tidal river. The water being salter below than above, the part of the casting immersed therein (the lower end of a cast-iron pile for instance) will therefore be in an opposite electric condition to that of the portion above, and the amount of corrosion of the positive element due to the kind of iron and the state of the water will be further increased or "exalted" by the negative condition of the opposite end, which will be itself in the same proportion preserved.

This principle extends to very many practical cases as to iron plates, &c., partly immersed in a solvent fluid, and partly exposed to moist air, &c.; and it suggests the importance of giving increased scantling to all castings intended to be so situated, to allow for this increased local destruction of material."

The majority of the so-called scientific commission recognized the essential character of the question of salt and fresh water with reference to such a station, as do the majority of the committee; they sought to evade this objection to that site, not by denying the saltness of the water at New London, as do the majority of the committee. This was admitted by both the majority and minority of the commission, but the majority, with ingenuous simplicity, suggested that a supplemental station might be procured some miles further up the river, in fresh water. To find one, however, at which the under current of the water would be fresh at all seasons, they would probably have to go above the mouth of the Willimantic, or to the city of Norwich. How entirely unanimous the members of the commission were on the subject of the destructive character of the water of New London will appear from the following extract from their reports.

The minority says: "The water is perfectly fresh at League island at all periods of the tide, and under all its variations, and those of the winds. *The site is therefore vastly superior to that at Winthrop's Point, where the water is salt at all times.* The bottom of an iron vessel fouled by a sea voyage would be cleared, and perhaps the grass be killed, by remaining at League island anchorage. The fresh water at League island has little or no effect upon an iron vessel, while the salt water at Winthrop's Point corrodes more or less rapidly even when coated, and the coating itself is an expensive operation. The spray from salt water in storms is very injurious to machinery near the sea shore, and to this the works at New London would be exposed, while those at League island would not."

The majority were no less distinct in their expression of opinion upon this question. They say: "*The water of New London is salt, which is*

undoubtedly injurious to the bottoms of iron vessels; fresh water for laying up such vessels when not wanted for active service can be found a few miles higher up the river. Still this separation of the vessels from the immediate supervision of the officers of the yard would be inconvenient, and attended with additional cost in the necessary precautions for their protection and safe-keeping. This objection could be obviated by providing means for taking such vessels out of the water when not required for immediate service. At League Island the water is fresh, and in this respect the board is of the opinion that the advantage is with League Island, so far as iron vessels are concerned."

Thus it appears that the commission was unanimously of the opinion that in this first great essential—fresh water—League Island had pre-eminently the advantage over New London. Indeed, the majority admit that New London, the acceptance of which they recommend, is, for this reason, unfit for the purpose of an iron navy yard, unless accompanied by a supplemental station a few miles higher up the Thames river. With a view to escape the inconvenience and additional cost of such an extraordinary arrangement, these "scientific" gentlemen suggest that the destructive influence of the water might be escaped "by providing means for taking such vessels out of the water when not required for immediate service."

Our navy now numbers over 600 vessels, our coast extends from the Bay of Fundy to the Pacific shores of British America—at least, our coastwise trade takes this immense range, and at the breaking out of the war our commercial marine exceeded that of Great Britain; and if we are to protect our commerce or maintain our rank among nations, the number of our vessels will not be diminished. Did the majority of that commission suppose that the machinery for raising the vessels of such a navy out of the water when not required for immediate service would cost nothing? Or had science not taught them that fresh water was the natural cure for the disease with which the water of the harbor of New London would affect them, and that no machinery or process that science or ingenuity has yet suggested could so cleanse them when thus elevated by machinery as the waters flowing around League Island? They probably were not aware that the mere action of the atmosphere of New London upon those vessels when thus elevated upon costly machinery would injure them 10.07 times as much as fresh water; nor had they probably learned that the iron steamer Michigan, our one vessel upon our northern lakes, has been afloat for 20 years in fresh water and never required cleaning, while had she lain in the harbor of New London three months her bottom would have been so fouled that mechanical skill could not have cleansed it, though a week's bath in the waters of the Delaware would.

The exposed condition of New London to attack from sea is in itself an insuperable objection to the construction of any important works at that point. The site proposed to be adopted is $2\frac{7}{8}$ miles from the mouth of the river Thames, which, as appears by the coast survey charts, is but $5\frac{3}{4}$ miles from the open sea; and it is not only undefended, but wholly indefensible against an attack by iron-clad vessels. Were a naval station located there, the defences required for its protection would cost largely more than the entire outlay for the establishment of an adequate iron ship station at League Island, and when completed would, as the experience of our New Ironsides has proven, be utterly inadequate. Colonel Ould, the rebel commissioner for the exchange of prisoners, who recently passed three days with General Butler, informed him that shells fired from Morris Island by our rifled guns had been picked up six miles and a-half from that island, and that Charleston was

untenable from the fire of our guns, though distant in a straight line four and a half miles from the city. The experience of the New Ironsides has also demonstrated that a vessel plated with 4½ inches of iron cannot be injured by any ordnance in use at the distance of 1,200 yards; so that, after all the defences suggested for New London should be constructed, she could approach and lie at distances ranging from 2½ to 4 miles from the proposed site, and never be within 1,200 yards of any point upon which a gun could be placed. She alone could lie in safety and destroy the amplest navy yard we might construct at New London.

But a foreign power need not confide the destruction of New London and whatever works may be placed on Winthrop's Point to one or a few vessels; for a whole fleet of iron ships of the largest class might anchor off Avery's Point and Long Rock, and bombard both city and point at leisure. There are but four harbors on the At antic and Gulf coast of the United States into which these English and French naval monsters, the Minotaur, Agincourt, La Gloire, and Normandy, could enter, and New London is one of them. Twelve hundred yards would give them impunity, but off Long Rock or Avery's Point they could execute their work of destruction with thousands of yards between them and any fortification that genius and labor could construct. It is therefore apparent that the defence of a naval station on this site would require a number of vessels adequate to the destruction of any hostile fleet to be kept in the harbor in time of war, and would, instead of imparting strength and energy to our navy, engage and engross no inconsiderable part of our naval power. The object of forts is the defence of cities; naval vessels are constructed for service at sea, and not for the protection of cities or naval stations.

That these assertions are not exaggerated will be apparent to any one who, bearing in mind that an iron-clad vessel is safe from the heaviest ordnance at 1,200 yards, will examine the charts of Long Island sound between Valiant Rock and the mouth of the Thames. The channel at the entrance of the sound is 4¾ miles wide, being between Little Gull Island and Race Point. The friends of this site assert that forts could be built on the island and point, and another on Valiant Rock, a small ledge lying near the middle of the channel, 2½ miles from Little Gull island and 2¼ miles from Race Point.

Unquestionably such forts could be constructed. What expense they would involve can only be imagined. It would be difficult to ascertain how many millions have been expended in fortifying the Rip Raps, but not difficult to ascertain that they have been few in comparison with what the fortification of Valiant Rock would require. The water in either channel at the shallowest point is 30 feet, and when all these proposed fortifications should be built, a fleet of foreign iron-clads invulnerable at 1,200 yards distance would have two channels, one 2¼ and the other 2½ miles in width, both of immense depth, through which to pass to the assault of the great American station for the construction and repair of iron and armored vessels. Nor can either of these channels be closed by obstructions. Their width and the great depth of water, the shallowest point that at which foundations for the supposed fort on Valiant Rock must be found being 30 feet, which, together with the powerful flow of the ocean into and from Long Island Sound, make it as impossible to obstruct the channels as it is to protect them by forts. It is unfortunate for the people of New London that nature has not given them the means of making their city impregnable against naval assault, but it would be folly in the American government to locate its means of constructing the materials for naval warfare in a position against which nature has so irreversibly recorded her decree. To do so would

be to act in utter disregard of the monitions of both science and experience. Portsmouth, in the channel, was the most extensive and complete of British dock yards. Its situation is not more exposed than Winthrop's Point, if so much. It has cost over $300,000,000. It has a surface of one hundred and fifteen acres, with a front wall of 3,900 feet. It has seven building slips, of which five are covered with iron roofs, and nine dry docks. It has two wet basins, one of 380 by 260 feet, furnishing an area of two and one-third acres, and into which four of the dry docks open, and one wet basin 250 feet square. It also has a slip of 660 feet long, with a wharf wall on each side. Famous as is Portsmouth in British naval history, it is no longer regarded with favor by the people or government. Improvements in ordnance have rendered it indefensible, and after much discussion in Parliament on a proposition to abandon it, it was determined to increase its defences by the expenditure of $50,000,000 in the construction of additional forts for its defence. It is, however, apparent that this additional expenditure, immense as it is, will not make it secure, and it has, therefore, been determined that no additional constructions shall be made there. It may be useful as heretofore in times of peace, but the British government understand that it will forever be a weak point when they may be engaged in war with a naval power. Chatham, on the river Medway, will henceforth be the great British naval station. It is at the extreme upper point of navigable water on the Medway, and there the heavy iron work for the British navy will be executed. It must supply the place of Portsmouth, and in that view has been greatly enlarged. It has a river wall of 5,000 feet, and a surface of 95 acres, besides the island of St. Mary's, very like League Island, but much smaller, which adjoins the yard, and contains 284 acres. Here have been constructed four dry docks and ten building slips, two of the latter covered with iron roofs. The ropewalk at this station is one of the most extensive in Great Britain, and employs 250 men constantly. The storehouses, shops, foundries, and timber docks are of the most complete character, and of immense magnitude. Should we make Winthrop's Point our Portsmouth, posterity will gladly find their Chatham at League Island, or if that shall have been otherwise appropriated, at some other equally defensible position on the fresh waters of the Delaware.

Another insuperable objection to this site is the topography of the ground offered, and the inadequacy of the quantity. Winthrop's Point proper, or the piece of ground first offered to the government, contains about 60 acres, most of the surface of which ranges from 20 to 40 feet above high-water mark. It has since been proposed to add thereto 140 acres of adjoining ground, a large portion of which is composed of solid granite and immense boulders, the surface of which varies in elevation from 20 to 120 feet above the level of high water. It is conceded that not less that 150 available acres ought to be accepted for this purpose by the goverdment, either as gift or purchase; and to reduce so much of the ground offered by the city of New London to a level suitable for the purposes of a navy yard would, as the quarrying of granite cannot be executed at less than $2 per cubic yard, cost millions of dollars; and were we at this site to quarry such basins as the French have constructed at Cherbourg, say three basins, the combined area of which is about 52 acres, of a depth, respectively, of 55 and 60 feet, or as the English have at Chatham, three basins, covering in all 60 acres, affording from 30 to 60 feet of depth below the lowest tides, the cost would be almost incalculable. Wherever we may establish such a station, large excavations will be required, and it would be madness to begin them on a granite bed the lowest superficial point of which is 20

feet, and the highest 120 feet above high water. To modern science nothing of this character is impossible, and the undersigned will not assert that adequate excavations for the purposes of the government could not, by an immense outlay of money, in a long course of years, be made at this site. To remove the immense mass of earth and rock that lies above the proper level for a naval station would be the work of time, and would involve great expense; but to quarry dry and wet docks and such basins as our navy requires would involve an expenditure of time and money so great as probably to lead to the abandonment of the work when experiment should have disclosed its magnitude.

To the expenditure involved in the attempt to construct a naval station at New London the government would have no offset, while at Philadelphia she owns a station, which, inadequate for her purposes as its limited dimensions are, obstructs the commercial development of the city, and which would sell readily for about $2,000,000. The city, anxious to be relieved of the embarrassments arising from the present location of the yard, tenders League Island, not in exchange for the old yard, but as a gift to the government. The facility with which its soil may be handled, the abundant supply of skilled workmen always seeking employment, and the cheapness of general material in that vacinity, render it probable that the money received for the old yard would more than reimburse the outlay made in the original preparation of the new station. From its extent of surface, geological formation, character of water, broad anchorage, nearness to a supply of coal, iron, timber, and all other materials and labor, and being, as it is, within the limits of a city whose population now approaches a million, and protected by the defences of that city, League Island could, with the outlay of a comparatively small sum, be converted into a naval station superior to any existing, and the possession of which the naval powers of the world would envy.

Winthrop's Point is utterly wanting in adaptation to the purpose to which it is proposed to appropriate it. No practical machinist would accept such solid foundations upon which to construct heavy percussion machinery. In respect to its adaptability for such a station as we now need, it is in eminently digadvantageous contrast with League Island. The majority of the members of the commission appointed by the Secretary of the Navy to examine these sites having made, as it now appears, an imperfect examination of League Island, reported that it was a reclaimed marsh, with a depth of from 26 to 56 feet of alluvium, and would require a filling of from 9 to 10 feet over the whole area. Yet, in view of this statement, and the fact that the river Delaware is sometimes obstructed by ice, the Secretary of the Navy urges its acceptance, and says, "there is no river east or north of it where the objection is not much greater." But on subsequent scientific examination, by boring the island at several points, under the supervision of an officer of the coast survey (Mr. George Davidson) detailed for that duty at the request of the Secretary of the Navy, these objections are found not to exist. After reporting in elaborate detail the results of each boring at intervals of less than five feet, and sending to the department specimens of the results produced at such intervals, that men of science might test the accuracy of his judgment, that gentleman states the results of his labors as follows:

"The borings and examinations which I have this day finished, and have herein described, establish the following conclusions:

"1st. That the surface soil averages about 3½ feet in thickness over the whole island; that it is a stiff, yellowish, clayey material, easily cut when wet, and very hard when dry.

"2d. That beneath this surface soil there is a stratum of very fine sand, laminated in places with dark, clayey matter. Where this lamination exists there is an average of twelve layers of each to the inch. This fine sand stratum reaches an average depth of about 25 or 26 feet over two-thirds of the embanked part of the island. At the extreme eastern and narrow end of the island it is about 45 feet in thickness.

"This stratum is not water-bearing, although water is found near the surface, under the clayey soil; it is damp and compact.

"3d. That beneath the fine sand stratum lies the coarse sand, gravel, and boulder stratum which was passed through at No. 2, to the coarse sand stratum.

"4th. That with such material it is not necessary to use any piling for such machine shops and machinery as abound in Philadelphia, nor for machine shops or buildings of the heaviest description; that proper foundations may be laid, on an average, about six feet below the surface of the fine sand stratum; that for the heaviest trip-hammers, for the heaviest trains of rolls, and for launching ways, it may be necessary to drive piling to the stratum of sand, gravel, and boulders. This opinion, in my mind, amounts to conviction."

The detailed report will be appended hereto, marked "A"

The correctness of Mr. Davidson's judgment is fully confirmed by the following letters from Messers. Lewis Taws, of Philadelphia, and Samuel Harrison, of Pottsville, Pa., than whom few men in our country have had better experimental opportunities of judging of the adaptability of soil for bearing such super-structures, as the government would probably erect on the site of such a naval station as that recommended by the President and the distinguished head of our Navy Department Mr. Taws is the mechanical manager of the immense establishment of the Messrs. Morris, at Port Richmond, and Mr. Harrison has been largely engaged in the construction of buildings for the heaviest character of iron machinery and work in this country, and superintended the construction of many of the largest government works connected with the railway system of Russia. The value of such experience cannot be disparaged.

PHILADELPHIA, *March* 29, 1864.

"DEAR SIR: Your letter of the 28th reached me at my house in Germantown too late for an answer by return mail. I hope I may still be in time, if my opinion can be of any use in establishing the fact that League Island is a proper place to locate a navy yard for the general purposes of our government.

"In visiting the place for the first time with any view to an examination, I have no hesitation in saying, from my experience in the location of our present establishment at Port Richmond, that no difficulty will be found for the proper foundations for machinery or buildings at League Island. Our boiler shops and smith shop have been erected on a foundation of similar deposit as that shown there. We have a steam hammer that has been working not less than ten years: it stands on piling which reaches the gravel some 10 or 12 feet below the present surface, and has not given us the least trouble. Had we met with rock formation we should have removed it to give place to a proper foundation of wood, as a hammer, to work successfully, must have an elastic medium.

"I cannot see any practical difficulty in making League Island the most desirable location for a navy yard of the greatest dimensions.

"If my experience in the constructing of machinery, or any practical

question, as far as that extends, shall be of a-ny service, it is at the com mand of the government.

"Respectfully yours, "LEWIS TAWS.

"GEORGE DAVIDSON,
"*Assistant U. S. Coast Survey, Washington, D. C.*

"P. S.—I have written to Mr. Harrison, at Pottsville, and requested him to give his opinion, as his residence for nine years in St. Petersburg, Russia, may give an idea of what can be done with a pile foundation, or buildings that were erected for machine purposes.

"L. T.

"NOTE.—I should have stated that the buildings for boiler and smith shops stand on the gravel formation, running from five to ten feet as t ıey extend towards the *river*, the hammer only standing on short piles. I mention this, as I was not sufficiently explicit in the statement.

"L. T."

"POTTSVILLE, *April* 1, 1864.

"DEAR SIR: Mr. Lewis Taws has stated to me, by letter, that you wished my opinion in regard to the adaptability of League Island for government machine works, and sent me the conclusions of your report.

"From my own observations at the time I visited the island with you, I have no hesitation in stating that it is a suitable place for all kinds of heavy machinery and buildings necessary for a navy yard, the ground being of that character most suitable for rolling mills, heavy forge hammers, and cranes. My own experience teaches me this from having placed heavy forge hammers on rigid foundations and found them to fail. For the Danville, Pennsylvania, rolling mill, excavations were made through alluvial, fine and coarse sand to the depth of about 15 feet. Upon the coarse sand a bed of cinder a foot deep was made, upon which an oak timber framing was placed for supporting the plates and housings of the mill. This is one of the largest iron works in the country, and has been in successful operation for more than fifteen years, the foundations proving of the best kind.

"The steam hammer at the works of Mr. G.W. Snyder, in Pottsville, has its anvil block on about ten feet in depth of oak timber, placed apart and crossed, in order to make it spring, the timber resting upon a gravel bed. It is located near to the bed of a creek, has been in operation thirteen months, and performs admirably.

"For the foundations of the Glendon rolling mill, at East Boston, piles were driven, upon which blocks of granite were placed to receive the machinery; but this failed on account of the rigid nature of the stone, and they were obliged to insert wood between the stone and machinery in order to give some elasticity.

"In some instances anvil blocks for large forge hammers have been placed upon cork for the purpose of obtaining elasticity, as was the case at the Woolwich yard, in England.

"So it is with railroads, the simple wooden ties produce less wear and tear upon the machinery and rails than any other arrangement tried.

"I have read the conclusions arrived at from your report, and endorce them without hesitation, believing that the material of which League Island is formed to be the most desirable kind for erecting the heaviest trip and steam hammers, rolling mills, and machinery, and buildings pertaining theretoo.

"Very truly yours. "SAM'L HARRISON.

"GEORGE DAVIDSON, Esq.,
"*Assistant U. S. Coast Survey, Washington, D. C.*"

That the opinions expressed by these gentlemen may not be depreciated by the suggestion that they have yielded to local influence or prejudice, the undersigned submit a brief extract from the lecture of Edward Pellew Halstead, Esq., captain R. B. N., on the Warrior, which may be found on page 122 of a volume entitled Lectures delivered before the Royal United Service Institution, which was published under the auspices of the British Government in 1861.

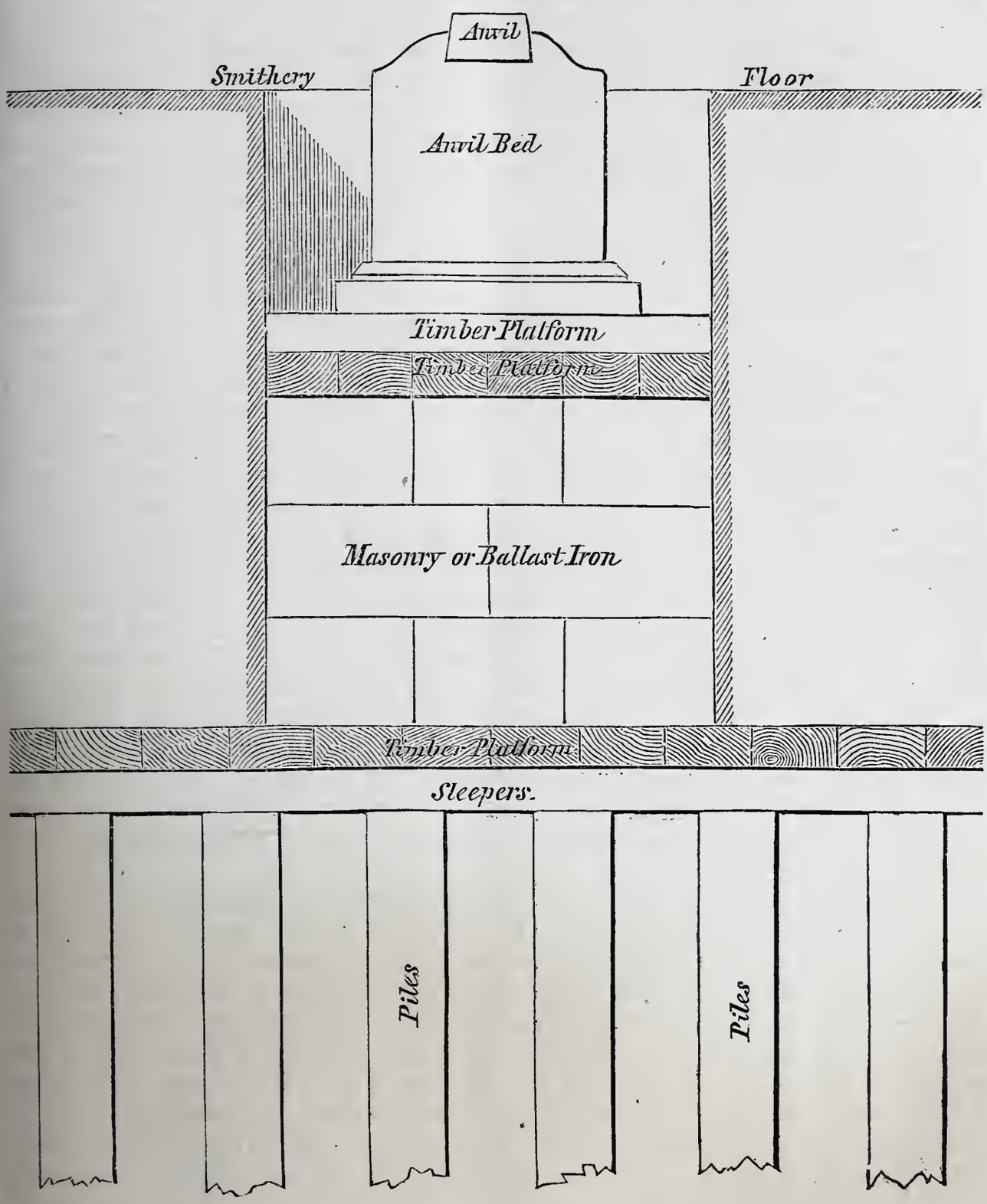
"I will now ask you to glance at plate four, before you, (to be found on the opposite page,) which represents the foundation for the anvil of a five-ton Nasmyth's hammer, the impacts from such hammers having the closest analogy to those of shot which any known mechanical operation as yet affords. You will see first a system of 16-inch pikes driven into the solid soil from the bottom of an excavation, itself thirteen feet deep; their heads then covered with a floor of closely packed 9-inch sleepers, in a double-crossed, solid mass, eighteen inches thick; then comes a six feet thickness of solid masonry or ballast iron; then the anvil bed, a solid block of cast iron five feet square, into a dove-tailed slot, on the centre of whose surface is inserted the 10-inch anvil itself; all this massive arrangement being absolutely requisite to save it from being 'smashed up' in its first turn at duty. By what? The impacts, not of the 68-pound, or 100-pound, or 120-pound steel shot, with a velocity of some 1,500 feet per second, but of the five-ton hammer in its fall by mere gravitation; and yet, with so many of these well devised arrangemnts, known to be absolutely requisite to prevent the destruction of the many 10-inch anvils at work in every dock yard, it is still held by the head authority over all dock yards that the 4½-inch plates on the sides of the dear old 'Alfred,' or 'Briton,' or 'Sirius' are receiving all that support which they can justly require, and that their 'break up' has been, and is, proof not of their insufficient 'foundation' or backing, but of their own inherent weakness, and of the superior power of guns."

Thus has accurate investigation, such as a really scientific commission would have made, demonstrated to practical minds of large experience the nice adaptability of League Island for the purposes of an iron navy yard, and dispelled the theory that any portion of it, save that under heavy trip-hammers, or trains of rollers or launching ways, would require piling.

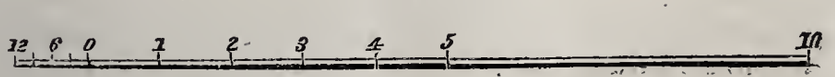
The majority of the "scientific" commission and the majority of the naval committee point to an unerring test of the accuracy of their theory that League Island and the neighboring meadows are a mere deposit of alluvium, when they consider the salubrity of the site. Accepting this theory, they disregard positive evidence, and declare the vicinity positively unhealthy. Were their premises correct, their conclusion would be inevitable; but as all the facts and evidence show that their conclusion is false, it is clearly apparent that their premises are erroneous, and that League Island and the meadows that are protected by its wall are not a "reclaimed marsh" or immense bed of alluvium. The majority of the commission say, "*although we are told that it is as healthy as other places in the vicinity, we cannot believe that League Island can be regarded as a healthy place;*" and the majority of the committee, without a single fact to sustain it, and in opposition to much positive information, echo and elaborate this erroneous opinion. The sanitary statistics and the tables of longevity and mortality of Philadelphia give her favorable pre-eminence among the cities of the Union, and the statements of all who were interrogated on the subject concurred in establishing the fact that the region contiguous to League Island is as healthy as any other part of the city.

This investigation has also shown that instead of requiring nine or ten

SECTIONAL VIEW OF THE FOUNDATION OR "BACKING" REQUIRED FOR THE TEN-INCH ANVILS OF FIVE TON NASMYTH HAMMERS.



Scale of feet



feet of filling, as the surface of the island averages but about two and one-half feet below mean high tide, the addition of four and one-half feet to its surface would raise it to the level above mean high tide of the wharves of the navy yards, at Philadelphia, Brooklyn, and Charlestown, and that for such filling it would itself supply the material in the process of the construction of the docks and other works that would be required at such a station. Work in iron, from the common blacksmith's forge to the heaviest furnace, is constantly productive of cinder slag or other material, which, when used for that purpose, makes a dry, solid and elastic surface. Were a granite hill-side, like that offered at New London, accepted for the purposes of an iron yard, the annual expense of removing such refuse matter would be no inconsiderable item, while the broad surface of 600 acres offered by League Island would for a long period after 300 acres had been occupied as a yard furnish room for the cheap and advantageous deposite of such material. Should basins and docks of but fifty acres, being less than the French have at Cherbourg or the English at Chatham, and of but thirty feet in depth, while theirs are respectively fifty and sixty feet deep, be constructed, we must remove material enough to fill up 300 acres of the surface of League Island five feet higher than it now is, or six inches above the wharves of the three yards we have named, or of any other of which we have knowledge in this country or elsewhere. It will thus appear that the fact that the surface of League Island is below the level of mean high tide, and which has been made an objection to its acceptance by parties interested in other proposed sites, is a great practical and economical advantage. In connection with these advantages, it should be remarked that the majority of the commission admit that League Island presents ample accommdations for safe anchorage and good holding ground, and that the minority state what is true and was easily ascertainable by actual measurement—that the "area of anchorage for large vessels off Winthrop's point and for a mile above, is but one-third that of League Island, the latter having in this respect thus very great (three-fold) advantage" and then add: "There is ample water both at League Island and New London for most vessels of the largest class of our navy. The Wabash fully equipped and armed, (drawing twenty-three feet of water,) has come up the Delaware to the present navy yard, and has gone to sea thence."

The site at New London has a comparatively limited frontage, while its anchorage is but one-third in extent, and less secure than that at League Island. Indeed no naval station in the world has a frontage of such length, so large and secure an anchorage in such deep water, or such an extent of surface, as League Island offers. In the essential qualities of defensibility, adequate supply of pure fresh water, broad and safe anchorage, the adaptation of its geological formation for the support of machine shops and other heavy structures, the nice adaptability of its topography for the cheap construction of docks and dry and wet basins, and the amplitude of its surface, League Island is probably unequalled in the world as a site for such a naval station as we require. Certainly, our country presents no one comparable to it in this combination of essential or important qualities.

Such an establishment as the President and Secretary of the Navy contemplated should be located at a point near a community from which it could draw, upon instant call, workman in every department in which it might have occasion to offer employment, and in which they could find employment when not required by the government. It may be, and it is hoped, there will be long periods of general peace, during which the government may require the service of comparatively few men for the purpose of keeping up our naval establishment by repair and gradual

construction. But in this matter, and with our recent terrible experience in view, we should remember the admonition of Washington, to prepare for war in time of peace; and our great naval station for iron and iron-clad steamers should be so located that on a day's notice the government could summon thousands of skilled workmen to temporary or permanent employment. The city of New London, as appears by the census of 1860, has a population of 10,115. The city of Philadelphia has over 11,000 skilled workers in iron and brass, and over 5,000 skilled machinists; while very few, if any, of the 10,000 people of New London are workers in iron and brass on a scale commensurate with establishments unrecognized as among the shops and foundries of Philadelphia. The navy yard at Philadelphia is the smallest of our naval stations, It employs at this time about 2,500 workmen, almost every one of whom is the head of a family, and allowing them an average of five members to each family, it will be seen that, small as that station is, its workmen and their families constitute a population that could not be housed, in the Philadelphia fashion of a separate house for each family, in New London, were the entire population of that beautiful city to surrender their homes to them.

It is also worthy of note that Philadelphia has more skilled machinists alone than New London has male population of all trades, callings and ages; that she has more workers in brass and iron than New London has population, male and female; and that her adult workers in the metals and coal outnumber the entire population of New London, male and female, by more than 100 per cent. League Island is within the limits of the city of Philadelphia, and all these workmen could dwell in their present homes, and, without inconvenience or extraordinary effort, give the government a full day's labor whenever it might require their service.

But it may be said this disparity may be overcome, and the government would be able to call from the city of New York a supply of laborers. In this connection it must be borne in mind that New York is by one-third nearer to Philadelphia than to New London, notwithstanding the fact that the majority of the commission, to whose report such frequent reference has been made, and which the majority of the committee call a scientific commission, located it as a suburb of New London, to the population of which they suggested its people could readily be added in such an emergency. But were New York as near to New London as it is to Philadelphia, it would not be well for the government to create an establishment which would compete with the Brooklyn yard for the skilled workmen of the commercial metropolis. The disparity between New London and Philadelphia in point of population will never be overcome. Indeed Philadelphia adds to her population year by year, and has done so for many years past, more than the entire population of New London. The following table gives the number of new buildings erected in Philadelphia for each of the last four years. Allowing an average of but six persons to each house, it will be seen that the constant annual increase of the population of Philadelphia must be largely above 10,115, the present population of New London:

1860	2,251
1861	1,825
1862	2,484
1863	2,795

The connection of this steady aggregation of tens of thousands of people with the subject before us will be readily seen by recurrence to the census of 1860. They will be employed in the pursuits which afford employment to the present population. By the census it appears that Philadelphia had, in 1860, 10,917 men employed in iron and steel manu-

factures, with a capital of $10,290,125, and a production of $14,775,213. In the adjacent townships, and within a few miles of the centre of the city, were 34 forges, foundries, and rolling mills, employing 2,430 men, and producing $3,888,151 annually. Within the limits of the city are six conspicuous steamship building works, four establishments at which heavy cannon are made of wrought and cast iron, and a number of establishments casting shot and shell; two extensive manufactories of small-arms, one of which, recently erected, is capable of turning out a quantity second to the Springfield armory only.

The following is a list of the number of works conspicuous for their extent in the leading classes:

Heavy machinist's tools, iron planes, drills, &c., 2; forges, for ship shafts and heavy plate and axles, 3; rolling mills—bar, plate and sheet, —12; heavy ordnance foundries, 2; manufactories of small-arms, 3; heavy ordnance, wrought, 1; shot and shell foundries, 3; shipping foundries and iron shipbuilding establishments, 7; steam engines and general machinery, 53; locomotives, axles, and car-wheels, 4; general foundries and building foundries, 25.

Exclusive of the manufacture of ordnance and arms, the following, from the United States census of manufactures for 1860, gives the aggregate of all the establishments in iron manufactures then found in Philadelphia:

	No. of establishments.	Am't of capital invested.	No. of hands employed.	Value of production.
General foundries: pipes, hollow ware, &c., &c.	45	$1,773,150	1,778	$2,366,683
General machinery: ship machinery, steam engines, locomotives, &c.	105	4,932,600	4,617	5,598,656
Rolled iron: bar, plate, &c.	19	1,133,000	1,311	2,338,777
Wrought iron: smithwork, sheet-iron work, &c.	376	1,435,825	2,020	2,633,469
Steel works, and various manufactures of steel, &c.	105	1,015,550	1,191	1,837,658
Manufactures in part of iron and steel; cars, carriages, wagons, &c.	190	1,961,050	2,529	2,930,733
Iron manufactures in adjacent townships within a few miles of Philadelphia:				
Furnaces and forges.	12	777,000	376	833,800
Foundries.	4	233,000	210	288,000
Rolling mills, on bar, rails, sheet, and plate.	12	1,917,610	1,680	2,611,251
Machinery and tools.,	6	117,000	153	142,600
Totals,	874	15,295,785	15,865	21,581,627

But, leaving the question of labor, let us turn to that of supplies. If possible, such a station as we contemplate should be located in a section of country abounding in coal, iron, and timber, that the government may procure them readily and at the lowest price, and not have cause to dread the possibility of any result of war cutting off supplies of these essential articles. The consideration of this branch of the subject relates to questions of economy, and not to essential elemental conditions, as did the questions of fresh or salt water, amplitude of site, and defensibility. Yet they are very important questions. The original outlay for a station when once made is ended, but the relative cheapnes of supplies is one which will continue to recur throughout the existence of the station. Philadelphiai s, as the Secretary of the Navy has said, "the commercial centre of the iron and coal regions" of the country. It is not denied that Connecticut produces some iron, but in what proportion to Pennsylvania we will show from the census. Coal is brought direct from the mines to Philadelphia over six carrying lines,

three canals, and three railroads, four of which have descending routes from the coal regions to the city. In view of these facts, it will be needless to add that coal is, therefore, always so much cheaper at Philadelphia as may be the difference between the cost of carrying it thither and to more distant points, or those reached by circuitous routes, and after one or more handlings of so weighty a substance, and one so liable to waste in handling. Connecticut produces no coal, and is dependent on the mines of Pennsylvania exclusively for her supply of Anthracite. A naval station at New London would have to draw its coal and iron from Pennsylvania, and most of it by the way of Philadelphia. This is not mere assertion, as will appear from the following exhibit from the census of 1860, showing the amount and value of coal produced by Pennsylvania, as compared with the production of all the other states in the Union.

	Tons bituminous.	Value.	Tons anthracite.	Value.
Pennsylvania	2,679,772	$2,833,859	9,397,332	$11,869,574
All other States	3,162,787	4,692,822	1,000	5,000
Total	5,842,559	7,526,681	9,398,332	11,874,574

Aggregate of anthracite and bituminous:

	Tons.	Value.
Pennsylvania	12,077,104	$14,703,433
All other States	3,163,787	4,697,822
Pennsylvania over all others	8,913,317	10,005,611

Connecticut, be it remembered, is not among the other coal-producing States. She has not a mine or a bed of coal that will pay for working. Pennsylvania's production of pig iron was, in 1860, 884,474 tons, valued at $19,487,790, an increase of 44 per cent. on the product of 1850. She makes 62.5 per cent. of the whole production of the country. How she compares in this respect with Connecticut (if it be not a contrast rather than a comparison) is shown by the following figures taken from the census of 1860:

	Tons of ore.	Tons of pig iron.	Value.
Pennsylvania	1,706,476	553,560	$11,427,370
Connecticut	20,700	11,000	379,500

Of bar and other rolled iron the following is the comparison:

	Tons.	Value.
Pennsylvania	259,709	$12,643,500
Connecticut	2,060	175,500

The people of New London have not engaged in the manufacture of steam engines and machinery, and she therefore furnishes no statistics under this head of the census to compare with those of Philadelphia. The product of Pennsylvania in 1860 was valued at $7,243,453. But, as we wish to speak more particularly of the city of Philadelphia, in this respect, we will present its production in comparison with that of the entire State of Connecticut. The value of steam engines and machinery produced in 1860, as shown by the census, was: The State of Connecticut, $1,953,535; the city of Philadelphia, $5,598,656.

Who, in the face of these facts, can seriously assert that New London is a more advantageous location for a government machine-shop and station for iron-work than Philadelphia?

Nor is the comparison between the two cities, in what may be termed minor supplies, such as lime and bricks, less favorable to Philadelphia. Eight quarries on the Schuylkill, in townships contiguous to the city, sold at or shipped through Philadelphia in 1860, 1,913,000 bushels of lime; 50,000 cubic feet of marble; 37,000 tons of limestone; total value, $237,000.

One establishment alone made 700,000 bushels of lime.

Bricks are exported from that city to almost every State in the Union, and the census report shows that in 1860, there were within the charter-

ed limits of the city 54 brick yards, employing 1,975 men, and making an aggregate value of $1,290,096 of pressed, common, and fire brick.

Unhappily the census does not give us the statistics of the production and trade in ship-timber, or the contrast between New London and Philadelphia in this behalf would be no less striking than it is in the matter of iron. On this subject we beg leave to submit the following extract from a pamphlet prepared by a special committee of the Board of Trade of Philadelphia:

"Central and Eastern Pennsylvania, with the vicinity of the Delaware bay and river in the States of Delaware, Maryland, and New Jersey, constitutes now the great source of supply of ship-timber to the Atlantic coast of the United States, live oak and southern yellow pine excepted. New York and Maine are particularly dependent on this source of supply for oak and mast timber.

"The interior, at the sources of the Susquehanna river, has an inexhaustible supply of white-pine mast and spar timber, white-pine plank stock and decking, all of the largest size. There is also an abundant supply of a variety of yellow pine, scarcely second to the southern yellow pine in strength and durability, brought from the Susquehanna region, but less in size than the white pine.

"The interior valleys also furnish the best long oak for keels, beams, long plank-stock, &c., now known in the United States, as do the counties bordering on the Delaware, and parts of the States of Delaware and Maryland. This district is celebrated for its superior oak, great quantities being cut for export to England; and no other part of the United States within reach of tide-water now yields oak of the requisite size for ship frames.

"Most of this oak and pine reaches the Delaware from the Susquehanna river in timber rafts, though some is brought by railroads and canals to the Schuylkill and Delaware rivers. Oak knees are most abundantly produced near the Delaware, and are brought by various modes.

"The following designations of timber for navy yard supply are now chiefly drawn from the sources named above:

1. White oak logs.
2. " keel pieces.
3. " promiscuous timber.
4. " plank (cut here.)
5. White pine mast and spar timber.
6. " logs (plank and decking.)
7. Yellow pine (of Penna.) logs, &c.
8. Ash logs, plank, and oars.
9. Hickory buts and handspikes.
10. Black walnut and cherry.
11. Locust (stanchions and trenails.)
12. White-oak staves and heading.

The following additional designations of timber are at least as abundant here as at any other point:

1. Cedar. 2. Poplar. 3. White-heart hickory.

"The sources of supply of live oak, southern yellow pine, cypress, and other semi-tropical timbers, are of course the same here as at other points on the Atlantic coast.

"Black spruce spar timber is obtained from Maine and the British provinces. This is the only description of ship timber required for naval purposes now brought from those sources, hackmatack knees being used only in small merchant vessels.

"The quality of the ship timber of Pennsylvania is in all respects superior.

"*First.* The oak is superior to all others in length, and in solidity and durability. The length is nearly double, on the average, to that cut in Maine; and as described in timber bills for eastern ship-builders, is, for keelson, streak, and planking, '35 to 50 feet,' with special length beyond these. The Delaware oak is also celebrated for its strength and durability, qualities attested by the preference long shown, by eastern and

English ship-builders, by the extraordinary strength of ships built here, (*vide* Cope's and Penrose and Burton's ships,) and also by the well known principles applying to this climate, soil, and the open-field growth peculiar here.

"*Second.* The pine of the Susquehanna is superior in size and in quality. Masts of 70 to 80 feet in length, and of 26 to 42 inches in diameter, (dressed,) are easily and regularly obtained. The lands from which they are cut are inexhaustible for a century. The planking is considered stronger than that cut from Canada pine. Pennsylvania yellow pine is abundant, clear, and makes excellent spars and plank, declared by our ship-builders equal to the best southern. It dresses smaller than white pine, and has a share of sapwood to be removed.

"Masts and spars are regularly supplied in all timber bills for ships to be built at New York and in Maine; they are sent in rafts, unfinished, to New York, through the New Jersey canals, and are sent dressed to the West Indies for repair of dismasted vessels."

Wanting as New London is in the essential requisites for an iron station, all of which League Island possesses in such eminent degree, viz., an adequate site with proper topography, absolute defensibility, and fresh water, she seems to be at odds almost as great in respect to these matters, which the undersigned readily admit involve questions of mere economy, but suggest are questions of scarcely secondary importance, in view of the fact that they involve daily expenditures, the amount of which would be enormously swollen by carrying the raw material of Pennsylvania and the contiguous States of Maryland and Delaware to New London for construction.

That New London has none of the essential requisites and no single advantage for the location of an iron navy yard has, it seems to us, been made apparent, and the undersigned beg leave respectfully to suggest that it is such a yard for which the President and Secretary of the Navy ask, and which the exigencies of the country require. By a letter, dated the 26th of last month, addressed to the naval committee of the House, the Secretary of the Navy again invites the attention of the committee "to the necessities of the government for a navy yard and establishment for the construction of iron vessels, and the machinery and armature resulting from the revolution that has taken place in the character of naval vessels within a comparatively recent period, and for which none of the existing navy yards are adapted;" and he adds: "The loss and embarrassment already to the government from the want of what is termed an iron navy yard can hardly be estimated. None of the present yards meet the wants of the service, and we ought, without delay, to arrange for a suitable establishment, if we would secure our ascendancy as a maritime power. A navy yard on a large scale, and in many respects differing from any we now have, which shall be furnished with all the proper facilities and aids for its operations, where vessels of iron as well as of wood may be constructed, machinery for steamers be manufactured, iron armature be made and tested, and repairs of every description executed, is wanted. We have no such yard, with its accompanying mills, forges, furnaces, and shops, to construct iron vessels and the machinery and armature which modern invention and progress have developed, and which must hereafter enter into the construction of a navy."

And again: "*It will be seen that the wants of the government are not for an additional navy yard of the description of those which we already have*, but one of a materially different character and of more ample dimensions, which will be commensurate with the wants of the survice, and

of the revolution that has been made in naval architecture by the introduction of steam."

If, however, in the face of the Secretary's reiterated assertion that he knows of no necessity for another yard such as we already have, and which must be confined to the construction and repair of wooden vessels, Congress should determine to establish one of them, the undersigned respectfully submit that New London is not the proper site even for such a station. Its absolute indefensibility is an insuperable objection, not only against placing an iron naval station there, but against placing any expensive government establishment for any purpose at that point. In our judgment this consideration alone is conclusive; but we may be permitted to suggest another objection not in itself vital, but worthy of grave consideration.

At the breaking out of this war we had seven stations upon the Atlantic coast. Three of them—those at Kittery, Charlestown, and Brooklyn—are east of the Hudson, and regarded by sailors familiar with our extended coast as on the same sheet of water. Those at Pensacola and Norfolk were taken possession of by the rebels, and have been destroyed; and should Congress determine to establish one or more ordinary stations, they should be distributed along the coast so as to give prompt protection to other cities than those on and east of the Hudson, and not be crowded into the comparatively small portion of our country which contains more than half of our existing stations. The question of an iron yard is a great national question and should be determined by the largest general consideration; and did New London, or any other point east of the Hudson, offer all the essential prerequisites and superior general advantages, the yard should be located there irrespective of the question of locality; but if the purpose be, as it would appear from accepting a site, remote from coal and iron fields, and bounded by salt water, to initiate an extended system of old-fashioned navy yards, the question of locality becomes an essential one, as the presence and protecting power of the government should, as far as practicable, be equally felt by all the people of the country.

And if such be the determination of Congress, the undersigned insist that League Island, apart from the geographical question, should be accepted, as it offers the cheapest, most extensive, and most advantageous site submitted to the committee. It is not only defensible, but defended. It embraces over six hundred acres. It has a wharf front of 23 feet depth, extending for more than two miles. It offers an anchorage secure in all seasons for an entire navy Its subsoil, though solid and of primitive formation, is easily handled. It is washed in the rear by an arm of the river two hundred feet wide, which could, at little cost be converted into a timber basin of adequate dimensions, and docks for the canal boats by which the station would receive its supply of iron and coal direct from the mine, furnace, and forge, leaving its entire front available for wharf and slip purposes. How important such a measure of wharf front would be, as a matter of economy, and how much it is needed, can only be appreciated by those who know how inadequate our public wharfage is. In a note to the naval committee of January 7, of the present year, Admiral Smith, chief of Bureau of Yards and Docks, urging the purchase of a few feet additional to the Charlestown yard, says: "I consider this purchase of the greatest importance to the government, as all our navy yards are so circumscribed in area, and particularly in water front, that we find it impossible to provide dockage and wharfage for all the vessels of the navy which come to the yards, especially at Boston, New York, and Philadelphia."

We have now, as has been said, six hundred steamers in commission,

and more steam vessels, we are officially informed, are constantly lying at the wharves of New York than the navy possessed in 1860. The expenditure for wharfage and demurrage which we are now incurring would probably pay the current expenses of one of our naval establishments. The majority of the committee have failed to disclose the fact that the comparatively limited wharf frontage of the proposed site on the main land at New London, would remove this constant source of expenditure, while the facts we have set fourth demonstrate that our iron vessels could not lie up in ordinary, or for repair, at wharves in that harbor without both corroding and fouling. It cannot be denied that sea water operates like a deadly poison on the surface of iron vessels, and that our government should have a wide field of fresh water in which to lay them up. This the broad anchorage off League Island, and more than two miles of wharfage it affords, would amply supply.

How great a matter of economy the establishment of such a yard would be is not disclosed by exhibiting the rates at which the government procures vessels from contractors who expect no other customer for such work, and therefore require to be paid in the price of the first vessel not only a profit on material and labor, but the cost of the extra machinery they are required to obtain for getting up this peculiar work, and which may be useless except for occasional government purposes. The department cannot expedite the construction of vessels in private yards; it cannot add to the force or control the operations of the workmen in such establishments. Had any considerable portion of the iron-clad steam batteries now in process of construction, the last of which, by the terms of the several contracts, should have been delivered in February last, and several of which were to have been delivered in the early part of last September, but no one of which has yet been handed over, been constructed at a government station, Plymouth would not have been lost to us, and our advance on Richmond would have been strengthened by their presence.

On this point the following communication, made to Congress by the Secretary of the Navy since the preparation of this report was begun, is very distinct:

NAVY DEPARTMENT, *May* 9, 1864.

SIR: I have the honor to acknowledge the receipt of the resolution of the House of Representatives, passed on the 2d instant, directing the Secretary of the Navy to furnish the House "with all the information in his possession concerning the construction of the rebel ram which participated in the recent rebel attack on the United States forces and vessels at and near Plymouth; also to inform the House why the construction of said ram was not prevented; whether any steps were taken to prevent the same, or to guard against the action of said ram; also what action was taken in relation to the subjects of this inquiry, and why the same was not effective."

In conformity with the requirements contained in the foregoing resolution, I transmit herewith copies of correspondence on the files of this department relative to the construction of the rebel ram referred to, and other matters connected therewith. I also subjoin a schedule of iron-clad gunboats of light draught in the process of construction, which, in anticipation of the state of things which now exists, were designed for service in the sounds and rivers of North Carolina, and the shallow interior waters elsewhere on the coast. These boats were contracted for as soon as it was possible to do so after the necessary appropriations for their construction were made by Congress, and it will be seen by the data given that most of them were to have been completed last year—

some of them as early as September. Not one has yet been delivered, and it will be some weeks before one can be made available for service.

I have felt it my duty on repeated occasions to call the attention of Congress to the necessities for a yard and establishment where iron and armored vessels could be constructed for the government, but the preliminary steps for such an establishment have not yet been taken. In the mean time the department and the government are wholly dependent on contractors who, if they have the will, do not possess the ability, to furnish these vessels promptly. Conflicting local controversies in regard to the place which shall be selected and benefited by the proposed important national establishment for an iron navy, such as the present and future necessities of the government require, have contributed to delay action on this important subject. Having in view economy as well as the public necessities, I have at no time recommended that the number of our navy yards should be increased on the atlantic coast, but it is my deliberate opinion that no time should be wasted in establishing at a proper place a suitable yard where iron ships can be made and repaired. We feel its necessity in the emergency which has called forth the present inquiry, and not a single contractor is able to meet his engagements, even for one of this class of small vessels. In the event of a foreign war with one or more of the principal maritime powers, our position would be most unfortunate, with no government establishment for the construction or repair of armored vessels such as modern science and skill are introducing.

The omission to make provision for such an establishment, on which the government can always rely, is to be regretted. Had we such an establishment at this time, I should not have been compelled to make this exhibit of a want of light-draught armored boats for such an exigency as that which now exists in the waters of North Carolina, nor is it probable that the exigency would have occurred.

Such incidental aid as the navy could render the army was cheerfully and earnestly given at Plymouth, as it ever has been given, always and at all times when its aid and co-operation could be useful. It has been less effective than it would have been, even with such boats as we have, in consequence of the unfortunate legislation of the last Congress, which, in its enrollment law, ignored the navy, subjected seamen to military draft, tendered large bounties to such as became soldiers, but allowed no bounty to those who entered the naval service, and would not even permit naval recruits to be credited on the quotas required to be drafted.

The remedial legislation of the present Congress has thus far effected comparatively few transfers. Some suggestions which I had the honor to submit to the Senate in March last, in answer to an inquiry as to what further legislation is necessary to supply any deficiencies of men for the naval service, have not, that I am aware, been reported upon, and many of our vessels, some of which would have been ordered to the sounds of North Carolina, are still without crews.

The correspondence of Acting Rear-Admiral Lee, and the naval officers, is evidence that there has been no neglect or inattention on their part at Plymouth or elsewhere in that quarter.

I have the honor to be your obedient servant,

GIDEON WELLES,
Secretary of the Navy.

Hon. SCHUYLER COLFAX,
Speaker of the House of Representatives.

The following is the list of vessels to which the Secretary refers, with the date of the contracts, and that on which each vessel was to have been delivered:

Names of vessels.	Names of Contractors.	Date.	Time.	Expiration.
		1863.		
Chimo	A. Adams, Boston	July 20	6 mos.	Sept. 17, 1863.
Cohoes	M. F. Merritt, New York	April 17	6 mos.	Oct. 17, 1863.
Casco	Atlantic Works, Boston	May 2	6 mos.	Sept. 14, 1863.
Etlah	C. W. McCord, St. Louis	July 9	8 mos.	Feb. 24, 1864.
Klamath	A. Swift & Co., Cincinnati	March 26	6 mos.	Sept. 26, 1863.
Koka	Wilcox & Whitney, Philadelphia	May 13	8 mos.	Dec. 24, 1863.
Modoc	I. S. Underhill, New York	June 4	6 mos.	Dec. 4, 1863.
Napa	H. & Hollingsworth, Wilmington	May 19	6 mos.	Sept. 2, 1863.
Naubuc	W. Prince, Williamsburg	April 2	6 mos.	Oct. 2, 1863.
Nanset	D. McKay, Boston	June 10	8 mos.	Feb. 10, 1864.
Shawnee	Curtis & Tilom, Boston	April 2	8 mos.	Dec. 2, 1863.
Squando	McKay & Aldus, Boston	May 4	6 mos.	Nov. 4, 1863.
Shiloh	G. C. Bestor, St. Louis	June 24	8 mos.	Feb. 24, 1864.
Suncook	Globe Works, Boston	May 2	6 mos.	Sept. 17, 1863.
Tunxis	Reary, Son & Archibald, Chester, Pa	April 16	8 mos.	Nov. 9, 1863.
Umpqua	Snowdon & Mason, Pittsburg	April 28	6 mos.	Sept. 9, 1863.
Wassuc	G. W. Lawrence, Portland	Nov. 3	8 mos.	July 3, 1864.
Waxsaw	W. Denmead & Co., Baltimore	May 13	6 mos.	Sept. 13, 1863.
Yazoo	Merrick & Co., Philadelphia	April 16	6 mos.	Sept. 2, 1863.
Yama	A. Swift & Co., Cincinnati	March 26	6 mos.	Sept. 26, 1863.

But it is said that the Delaware river is long, and sometimes interrupted by ice, and it is argued that the depth of water is inadequate for future naval purposes, and these considerations seem to have controlled the majority of the committee. Philadelphia was not considered too remote from the sea by the able men who located our yards more than half a century ago, before steam was used for the propulsion of vessels; and if its superior advantages for a naval station in those days countervailed the difficulty of the navigation of the Delaware under sail, they should not be disregarded now when it is the commercial centre of the coal and iron regions, and when iron enters so largely into naval structures, and steam propels our vessels regardless of wind or tide. It is not now a question of so many miles of river to be traversed when the wind or tide favors or permits, but of so many hours of travel in smooth water by steam. Philadelphia is about nine hours from the ocean.

The length of the Delaware river, the fact that its channel is narrow, almost as narrow at certain points as the Clyde is for its whole length, from Renfrew to Glasgow and above, being at one point but about five hundred yards wide, and that over one narrow bar its channel is comparatively shoal, being but twenty-four feet seven inches at mean high tide, are not facts that militate against League Island. They are each one an argument in favor of its acceptance.

At such a distance from the sea the water is, under every possible condition of wind and tide, perfectly free from salt. How great an advantage this is has been shown. For the navigation of the river an experienced pilot is needed and can always be had by our government, though a foreign war vessel would not often, if ever, be able to command one.

Where the channel narrows to less than one thousand feet, the heaviest iron ship would have to come within effective range of our ordnance from earthworks on the banks, as well as from the forts the government has already constructed at such points. Nor would they be subject to such fire merely for the brief time required for steaming past a given point, as the river could at such points be obstructed at little expense as effectually as Charleston harbor has been.

It is argued in this connection that iron vessels heavier than the Warrior, La Gloire, &c., and of a draught of water hitherto unknown except

in the case of the Great Eastern, will be constructed for our navy. Such is not the fact. The English and French have found vessels of such heavy draught to be failures, and will build no more; and the Delaware has adequate depth of water over the shoalest bar for the largest vessel contemplated by our Navy Department—one of 7,500 tons. Vessels of the class referred to, and the Great Eastern, are properly spoken of as monsters; they are not in harmony with the forces and proportions of nature. A vessel to be available for commercial or national purposes must be able to enter harbors for repair and supplies. Neither governments nor merchants will build vessels to keep them perpetually at sea. Nothing but fancy could suggest such a folly. The following table exhibits the extreme depths of water in the leading harbors of the country; it shows that the great iron ships of England and France would be almost useless in a war with us, as there are but four harbors on our Atlantic and Gulf coasts—Portsmouth, Newport, Key West, and New London—they could enter; it also shows that there are but nine harbors on our Atlantic and Gulf coasts, of which Philadelphia is one, that will admit vessels drawing over eighteen feet at mean low water, and that there are but four of them, including New London, that will admit vessels drawing over twenty-five feet at mean low water. About twenty-three feet appears to be the extreme depth that may be given to vessels for naval or merchant uses along our coast; and as we are destined at an early day to be recognized as the leading maritime power of the world whom France and England will most dread, the character of our coasts and the capability of our harbors will determine the character of the vessels they will construct. It is therefore apparent that the Delaware below Philadelphia has adequate depth of water for ships of the heaviest draught likely to be built. It has on the shoalest bar, that opposite Hog Island, twenty-four feet seven inches at mean high water, and twenty-five feet two inches during the spring tides. This table was prepared from the Coast Survey maps by an officer of that department:

	PLACES.	LIMITS BETWEEN WHICH DEPTHS ARE GIVEN.	LEAST WATER IN CHANNEL-WAY.				AUTHORITIES.
			MEAN.		SPRING TIDES.		
			Low Water.	High Water.	Low Water.	High Water.	
			Feet.	*Feet.*	*Feet.*	*Feet.*	
1	Portsmouth.....	From Whale's back to Fort Constitution.	42	50, 6	41, 4	51, 3	See Coast Survey Map.
2	Newport.....	From Newport Harbor to Prudence Island.	31	34, 9	30, 6	35, 2	Do.
3	Key West,.....	Across the reef to the anchorage	27	28, 3	26, 9	28, 5	Do.
4	New London,.....	Mid-channel.....	25, 2	27, 7	25	28, 1	Do.
5	New York.....	Crossing the *bar* by Gedney's channel; two miles outside Sandy Hook.	23	27, 8	22, 6	28, 1	Do.
6	Chesapeake Bay	Up to Norfolk.....	23	25, 5	22, 8	25, 8	Do.
7	Pensacola.....	On the *bar;* 1½ miles outside the points.	22, 5	23, 5	22, 3	23, 8	Do.
8	Port Royal.....	On the *bar;* 7 miles outside the points.	19, 5	25, 9	19, 2	26, 5	Do.
9	Salem.....	Inside Salem Neck.....	19	28, 2	18, 3	28, 9	Do.
10	Delaware River..	On the *bar;* opposite Fort Mifflin; smooth water.	18, 5	24, 7	18, 4	25, 2	Do.
11	Boston.....	Channel between Governor's Island and Castle Island.	18	28	17, 3	28, 6	Do.
12	Portland.....	From Breakwater to the *anchorage.*	16	24, 9	15, 5	25, 4	Do.
13	Mississippi river	Southwest pass; over the *bar*	13	14, 1	12, 8	14, 2	Do.
14	Galveston Bay...	On the *bar;* 3 miles outside Fort Point.	12	13, 1	11, 7	13, 3	Do.
15	Mobile Bay.....	To the "Upper Fleet," (on the *bar*, 21 feet)	12	13	11, 7	13, 2	Do.
16	Charleston.....	On the *bar:* off Morris island	11	16, 3	10, 8	17, 1	Do.
17	Savannah.....	Channel up to the City.....	11	17, 5	10, 6	18, 2	Do.

It is notorious that the largest ships in our navy have crossed Hog Island bar, and that owing to the fact that the water in the Delaware is always smooth, which in rough weather is an advantage equivalent to many feet, vessels such as the Cathedral, unable to enter New York harbors when the waters were rough, have sailed around and discharged their cargoes safely in the port of Philadelphia. This objection to the acceptance of League Island is purely factitious.

It is also said by those who urge the acceptance of Winthrop's Point that the navigation of the Delaware is seriously obstructed, and vessels navigating it are endangered by ice. These statements are, in the judgment of the undersigned, very much exaggerated by the report of the majority of the naval committee. It is true that the Delaware, in common with all the rivers of the loyal States, yields to the low temperature of the brief spells of extreme cold that sometimes prevail throughout the northern Atlantic States. Her waters, like those of the Thames, are subject to the general laws of nature. This objection can hardly be made in good faith by those who advocate the acceptance of a position on the Thames. The latitude of Connecticut is higher than that of Delaware, western New Jersey, and southern Pennsylvania, the country intersected by the Delaware, and the winters are, consequently, longer, and their mean temperature lower. Therefore, if the water of the Thames be not salt for a distance much higher than the undersigned have been led to believe, the ice in that river must be more compact and heavy, and endure for a longer season, than that on the Delaware. So free is the wide anchorage in front of League Island, which, it should be remembered, is three times the width of that of Winthrop's Point, from the effects of floating or pack ice, that it has been used for a long series of years as the point at which to anchor the government iron buoys not in use during the winter. It will also be remembered that Joshua Humphreys, in his report on the fitness of New London for a naval site in 1800, said: "The river is frequently full of ice, the breaking up of which makes it dangerous to vessels to lie in it."

And again:

"Vessels in this port are subject to be injured by ice in the winter if they lie in the channel. To deepen the basin sufficient to move vessels inside of the dock, to keep them clear of ice, would cost a considerable sum, and be an annual expense to keep it sufficiently clear."

How well founded and correct his judgment was will be recognized by any who, bearing in mind the low mean temperature of the winters in that latitude, will also remember that, through the narrow anchorage three-quarters of a mile wide off Winthrop's Point, but one-third the width of that off League Island, the ice finds its way to the sound not only from the Thames, but the Yantic, Willimantic, the Susquetoncut, the Little river, the Shetucket, the Nachang, the Hop, the Moosup, the Mile, the Quinebaug, and other rivers, for all which the Thames is the outlet. It is not claimed by the friends of League Island that the Delaware is free from ice at all times. To do so would be to follow the example of the advocates of New London and disregard the operations of nature. In the winter of 1856–'57 a locomotive was taken across the Potomac, below Washington, on the ice, and for six weeks the immense travel of the Philadelphia, Wilmington, and Baltimore railroad crossed the Susquehanna on tracks laid on the ice. New York harbor was closed, Boston harbor frozen down to the islands so solid that pleasure parties visited them in sleighs; and Long Island Sound, into which the Thames enters, was entirely frozen over. Yet in that extreme weather the navigation of the Delaware was interrupted for but one week, as will appear from the following extract from a letter of Henry Winsor,

Esq., manager of the Boston and Philadelphia line of steamers, dated April 2, 1864:

"I am largely interested in a line of steamers running between this port and Boston, and have been the manager of the line in Philadelphia from its commencement, in 1852, to the present time. The winters of 1855–'56 and 1856–'57 were very severe—the severest of any within twenty years; but our steamers have made their regular trips through all the winters of these twelve years. A steamer arriving at this port, and another departing every week, save one in February, 1856, when one of our steamers could not get above Chester, where she discharged her cargo, and it was brought to Philadelphia by railroad. That winter was the severest, or one of the severest, ever known in this country, and Long Island sound was then entirely frozen over so that steamers could not run on it. So difficult was it at that time to transport goods between New York and Boston that we were urged to run one of our steamers from Boston, outside of Long Island, to New York, and, as an inducement, much higher rates of freight were offered than we charged to Philadelphia; but we refused, preferring to continue our regular business."

On the subject of insurance, to the consideration of which the majority have given space in their report as an offset to the advantages League Island possesses in cheapness of coal, iron, timber, labor, and other matters, and on which they have been sadly misled, Mr. Winsor says:

"In regard to insurance, the fact is that Philadelphia policies have no 'ice clause,' as is alleged, and are in that respect as clean as New York or Boston policies. We insure our steamers by the year at as low a rate of premium as any steamers are insured, running coastwise between any other ports. On goods by our steamers to and from Boston the rate is one-half of one per cent. in summer and five-eighths in winter, which is the usual difference between summer and winter rates elsewhere; and our insurance companies take risks from all foreign ports throughout the year at the same rates of premium as the insurance companies of New York charge to that port. One of the rules of our board of underwriters is this: that if rates in New York are at any time reduced by leading insurance companies there, the rates here shall at once be made to conform. The only ground for the report of special ice rates in Philadelphia is the fact that, when parties apply for insurance in a severe winter such as those of 1855–'56–'57, and there is more ice than usual in the river, *on vessels known to be coming in at that time*, our insurance companies do sometimes charge higher than the usual rate on such vessels; but this is very rarely done, and the increase of rate is so small that it amounts to little. Mr. Hand, president of the Delaware Insurance Company, (our largest company,) informed me that the aggregate of his 'ice premiums' for the whole term that he had been president, fourteen years, did not amount to $500."

The statements of Mr. Winsor are fully corroborated by the following named gentlemen: Thomas C. Hand, President of the Delaware Insurance Company; Arthur G. Coffin, President of the North American Insurance Company; Henry D. Sherrard, President of the State of Pennsylvania Insurance Company; and Richard H. Smith, President of the Union Insurance Company.

It is not denied that accidents have happened to vessels in the Delaware river. It is not claimed that its waters are charmed, or able to give exemption to men or ships from the ordinary vicissitudes of marine life; but it is asserted that considering that the arrivals coastwise and foreign at the Port of Philadelphia, average more than thirty-five thousand per annum, and are distributed throughout the fifty-two weeks of

the year, they are fewer than they will probably be in the neighborhood of New London, should that port ever secure such a commerce.

The following table exhibits the number of foreign and coastwise vessels that arrived at the port of Philadelphia each month during the last five years.

MONTHS.	1863.		1862.		1861.		1860.		1859.	
	For.	Coast.	For.	Coast.	For.	Coast.	For.	Coast.	For.	Coast.
January,	44	1,269	25	467	27	345	35	295	19	402
February,	34	1,350	38	989	34	578	30	367	36	595
March,	61	1,911	48	2,242	46	1,975	59	2,488	48	1,655
April,	52	2,877	70	3,447	64	3,169	66	3,649	54	2,942
May,	71	3,558	72	3,757	82	3.708	77	3,951	74	3,492
June,	66	3,492	67	2,802	45	3,463	60	4,221	57	3,809
July,	66	2,623	65	3,197	41	3.036	49	3,925	59	3,808
August,	46	3,266	48	3,875	30	3,619	43	4,193	40	4,258
September,	41	3,986	33	3,980	43	3,786	38	4,380	34	4,349
October,	51	4,031	47	4,405	35	4,147	66	4,574	36	4,470
November,	40	3,356	37	3,545	46	3,643	40	3,690	41	4.332
December,	33	2,337	47	2,457	39	3,108	28	2,171	25	2,266
Totals,	605	34,096	597	35,164	532	34,577	592	37,904	523	36,378

Were the statements on this subject contained in the majority report strictly accurate, the winter months would not exhibit such results as are disclosed in the foregoing table, which fully vindicates the assertion of the Secretary of the Navy, that "there is no river east or north of it (the Delaware) where this objection is not much greater."

In this conclusion the undersigned are happy to say the Secretary is fully sustained by the enlarged experience and sound judgment of the chief of the Bureau of Yards and Docks, Rear-Admiral Joseph Smith. Misled by the false statements of the majority of the "scientific" as to the formation of League Island, he has hesitated about recommending its acceptance; but his hesitancy was in no degree produced by the length of the river Delaware, or the alleged difficulty of its navigation.

The existing yard, over which he has so long presided, is above the Horseshoe—the chief point of winter obstruction; yet he has called the attention of the Secretary to the propriety of doubling the size of that yard by a purchase of ground on its southern line at a cost of about $300,000. To this suggestion the forcible response of the Secretary, as appears above, was, "but, besides involving a large expenditure, it, (that yard) would then be insufficient for our future iron navy." It was also, as will be seen by reference to the foregoing extract from the Secretary's last annual report on the suggestion of Admiral Smith, that he recommended an examination of Marcus Hook, a point on the Delaware a few miles below Philadelphia. Did the undersigned doubt the correctness of their conclusions, their consideration for the integrity, experience, and judgment of the venerable and distinguished chief of the Bureau of Yards and Docks would satisfy them as to the adequacy of the river Delaware, and the many advantages it offers for an iron naval station.

In conclusion, the undersigned beg leave further to suggest that two other sites have been considered by the committee—one at Marcus Hook, on the Delaware, and the other at New Castle, on the same river; and that while neither of them offers so many or such decided advantages as League Island, each of them possesses great advantages over New London. They are on fresh water; are defensible; and neither of them is so remote as that city from a supply of coal, iron, timber, or labor.

After a careful review of all the facts and allegations submitted to the

committee, the undersigned are of opinion that League Island is a proper and the best site offered for such a navy yard as the government requires, and recommend the adoption of the following resolution:

Resolved, That the Secretary of the Navy be instructed to accept the title of League Island, in the city of Philadelphia, if the same be perfect.

WILLIAM D. KELLY.
J. G. MOREHEAD.

The undersigned concurs in the favorable presentation of the claims of League Island as the proper place for the location of the contemplated naval depot for the construction of docks and repair of iron-clad vessels. Of the points which have been named, he believes League Island to be the most suitable place. But he does not concur in all that is said prejudicial to New London. He thinks New London has many substantial reasons in its favor for the location of this depot, and next to League Island, believes it to be the best point for it.

JAMES S. ROLLINS.

APPENDIX A.

Official report of the results of several Borings made at League Island.

GERMANTOWN, PA., March 22, 1864.

DEAR SIR: In accordance with your instructions, received February 20, I immediately made preparations for the required borings on League Island.

To avoid error as much as practicable, they have been made through cast-iron tubing of eight inches internal diameter; and that this report may be properly illustrated, I herewith forward a box containing forty-two specimens of the different borings at various depths, and a map showing the positions of these and previous borings. I was upon the island nearly every working day, and in most instances removed the specimens from the augur myself, or received them from the pump.

Whilst the regular borings were in progress I instituted other examinations upon the island, such as forcing a steel-pointed iron rod through the alluvial deposit; digging through the upper clayey stratum of surface soil to the fine sand stratum; examining the stone embankment to detect any point of settling; measuring the oak and maple trees, and ascertaining their ages by cutting; studying the system of drainage; and examining the gravel hills on the north of the island.

BORINGS.

No. 1, 1864, was selected at the upper or eastern and narrow end of the island, and is located in the most unfavorable and unpromising position—a fact readily appreciated by an examination of the surrounding topography. It is 112 yards from the outer edge of the river embankment, along the outer edge of which a line of trees is growing. Drainage at this part of the island bad.

The following are the results of the borings designated No. 1 on the map:

Surface to 2½ feet—2½ feet of stiff yellowish clayey soil, cutting readily when wet; very hard when dry. Specimen No. 1.

2½ feet to 18 feet—15½ feet of fine sand, laminated with dark clayey material. The upper eight feet holds the surface water. Specimen No. 2 at five feet from surface; specimen No. 3 at ten feet; specimen No. 4 at fifteen feet; specimen No. 5 is the material from ten feet, washed. It yields fine sand 53 grains. Specimen No. 6, a stone brought up from 13 feet.

18 to 28 feet—10 feet of fine sand, laminated with clayey matter, damp and compact; wet, water-bearing. The laminæ average twelve of each to one inch.

28 to 31 feet—3 feet of laminated clay and fine sand, the former predominating; gravel stones scattered through it; damp and compact. Specimen No. 7, in bag.

31 to 42 feet—11 feet of fine sand, clay and coarse grit sand, laminated; not so dry as between 18 and 28 feet.

42 to 42½ feet—½ foot of grit sand and coarse gravel; one stone as large as a man's hand.

42½ to 45 feet—2½ feet of fine sand, clay and grit and sand, laminated; small fragments of leaves and vegetable matter; wet.

45 to 48 feet—3 feet coarse grit sand and pebbles, believed to be water-bearing. Specimen No. 8.

48 to 54 feet—6 feet fine sand and clay, laminated; the clay predominating, and carrying small specks of bright blue clay, the first time noticed; stiff and compact. Specimen No. 9.

54 to 61 feet—7 feet of fine reddish sand, compact, dry, and hard to bore. Specimen No. 10. Stone at 56 in this sand, specimen, No. 11.

61 to 64 feet: 3+ feet of coarse grit, sand, gravel, and boulders. Specimens in bag No. 12. The boring through the gravel and boulder stratum was stopped, reserving to another position a further examination of its thickness.

Boring No. 2, 1864.—The position is marked upon the map, and lies in the angle of two draining ditches; drainage bad and surface of ground wet.

Surface to 3 feet—3 feet of stiff yellowish clayey soil; cuts readily when wet, very hard when dry. Specimen No. 13.

3 feet to 21 feet—18 feet of fine sand, laminated at irregular intervals with clay; a few small specs of bright blue clay at about 20 feet, damp and compact. Specimen No. 14, at five feet from surface; specimen No. 15 at ten feet; specimen No. 16 at fifteen feet; specimen No. 17 at twenty feet.

21 to 29 feet—8 feet of coarse grit sand, gravel, and boulders, believed to be water-bearing; penetrated in four days.

2 feet, 1½ feet, 1½ feet, and 3 feet, respectively, some boulders too large to bring through tubing, and had to be forced aside. Specimen at 21 feet, No. 18, in bag.

29 to 30 feet—1 foot of coarse grit sand and large pebbles. Specimen No. 19.

30 to 33 feet—3 feet of coarse grit sand, and large pebbles. Specimen No. 20, in bag. Boring suspended. Boring of 1851 through the gravel and boulder stratum into the sand confirmed.

Boring No. 3, 1864.—Position marked on the map, and is not far from the third boring of 1862, and the 85-feet well of 1851. Point selected in the wetest ground of the island; drainage very bad, and ground broken up by cattle, A steel-pointed ⅝-inch round iron rod readily penetrates three or four feet when it strikes the fine sand and clay lamina.

Surface to 3 feet—3 feet of stiff yellowish clayey soil; easily cut when wet; very hard when dry. Specimen No. 21 at one foot; specimen No. 22 at 2⅔ feet.

3 feet to 21½—18½ feet of fine sand, with very few laminæ of clay; damp and compact; not 6 inches of surface water in tube at 21 feet. Specimen No. 23 at five feet from surface; specimen No. 24 at ten feet; specimen No. 25 at fifteen feet; specimen No. 26 at twenty feet.

21½ to 23½+ feet—2+ feet of coarse grit sand, gravel, and boulders. Specimen No. 27, in bag. Boring suspended; did not deem it neces- to again penetrate the gravel stratum.

Naval Committee of the House examined this boring and saw what had been taken out.

Boring No. 4, 1864.—This position is 15 feet west of the second boring of 1862, (with tubing,) and 50 feet west of a large draining ditch which is rarely dry, owing to insufficient sluice way.

The auger had been down 5 feet when the Naval Committee of the House visited the place; the hole was then ready to receive the tubing, and had a quantity of water in it from between the clayey soil and sand stratum.

Surface to 2 feet—2 feet of stiff, yellowish clayey soil; easily cut when wet; hard when dry. The clay at this end of the island is not so compact as to the upper end.

2 feet to 25 feet—23 feet of fine sand and clayey material laminated. After the first water was pumped out the borings showed compact and damp. More clay after 20 feet below the surface than at any of the previous borings. In the clay, at 20 feet to 24 feet, a few small specks of bright blue clay are found, the same as at 48 feet in No. 1 and at 20 feet in No. 2. Soecimen No. 28 at 3 feet from the surface; specimen No. 29 at 5 feet; specimen No. 30 at 15 feet; specimen No. 31 at 20 feet; specimen No. 32 at 24 feet.

25 to 26 feet—1 foot coarse grit sand, with a few small pebbles. Specimen No. 33.

26 to 27 feet—1 foot of fine clay and sand laminated, the latter preponderating as at 24 feet. Same as specimen No. 32.

27 to 29+ feet=2+ feet coarse grit sand, gravel, and boulders. Water-bearing. Specimen No. 34 in bag. Boring suspended, because it was not deemed necessary to again pass through the gravel and boulder stratum.

Boring suspended.—The following facts in relation to the penetration of the fine sand stratum, beneath the clayey surface soil, are introduced to illustrate the firm and compact nature of the stratum. The eight-inch cast-iron tubing, with a sharp steel cutting edge, will not penetrate it by its own weight, (35 pounds to the foot,) nor with heavy balks of wood and chains attached to two sections of 8 feet each. It is necessary to pass the auger below the tubing and to withdraw the material from below before the tubing with attached weights will sink.

At No. 3 there was hardly a depth of 6 inches of water in the tube just before striking the gravel. At No. 4 there was so little water in at 15 feet that it was necessary, upon leaving it at night, to carry water from the ditch to fill the tubing, to guard against the possibility of a water-bearing stratum of sand bursting into the lower end of the tubing, and allowing it to sink therein whilst the workmen were away. But the possibility did not occur, and weights were used to force down the tubing.

As already detailed, the work through the gravel and bou der stratum was very slow and laborious. Besides the weight of 32 feet of tubing, (1,120 pounds,) there was a weight of about 2,000 pounds attached thereto. It was impossible even then to force the boulders into and through the compact bed of gravel and sand, and the larger ones had to be worked on one side of the tubing to allow it to penetrate.

No. 5.—At the position so marked on the map, and alongside the head of a draining ditch, I dug below the clayey surface soil and struck the fine sand at three feet. The specimen No. 35, consisting of sand and clay laminated, was obtained at 3½ feet below the surface. It was damp and compact.

No. 6.—At the position so marked on the map, and alongside a draining ditch 133 yards from the river, I drove down an iron rod, ⅝ of an inch in diameter, with a sharp steel point. Felt the sand distinctly at 4½ feet; at 8½ found a compact layer, then sand again; at 12 feet another compact layer, then sand; at 14 feet another compact layer, then sand; at 20 feet it was hard work with three men to force down the rod by jerks. It was occasionally partially withdrawn to allow the surface water to pass down. Finally succeeded in forcing the rod to 23 feet with a force of about 550 pounds, applied by jerks.

No. 7.—At the position so marked on the map, and 175 yards from the river, I drove down the iron rod before mentioned; felt the sand at 4 feet; compact layer at about 12 feet; then sand; compact layer at about 16 feet; then sand; finally reached 24 feet with a force of 450 pounds applied in jerks, and believe I reached the gravel. Beyond 16 feet it was necessary to partially withdraw the rod several times to let the water into the hole.

No 8.—At the position so marked upon the map, 52 yards north of boring No. 4, 1864, and of boring No. 2 of 1862, drove down the iron rod used at Nos. 6 and 7. Selected an old filled drain leading into the draining ditch. Struck the sand at 4 or 5 feet; compact layer at 11 feet; then easy through sand for some feet. With three men and heavy oak plank managed to reach 25 feet. Could not say what was struk at that depth.

No. 9.—At the position so marked on the map, 29 yards from the river, and 10 yards inside the principal draining ditch, which was half full of water, dug to 4 feet and obtained the specimen No. 36. Water bearing between the upper clayey soil and the sand. Fine sand with damp clay laminated; former predominating.

No. 10.—At the position so marked upon the map, 33 yards from the river, and in the angle of the draining ditches, which were half full of water, situation wet. Dug to 4 feet and obtained the specimen No. 37. Fine sand and dark clay laminated; former predominating, damp and fine. Water bearing between the upper clayey soil and the sand.

No.11.—Position so marked upon the map between boring No. 4, 1864, and the river. It is 33 yards from the outer edge of the embankment, and near the principal ditch, which was half full of water. Water bearing between the upper clayey soil and the sand. Obtained specimen No. 38 at 4 feet from surface; fine sand and dark clay laminated; former predominating.

No. 12.—Position so marked upon the map on the west end of the island, 33 yards from the embankment facing the Schuylkill, and inside the principal draining ditch, which was half full of water. Dug through the clayey soil. Water bearing between it and the fine sand. Obtained specimen No. 39 at 4 feet below the surface; fine sand and dark clay laminated; former predominating.

No. 13.—Position marked on the map. It is on the north side of the island, between the Schuylkill river and Broad street, and 33 yards from the back channel. Dug to 4 feet and obtained specimen No. 40. It is part of the upper clay soil.

No. 14.—Position so marked on the map. A well was bored here some years since to obtain water for dairy use, 8-inch tubing used, and the lower end said to be in the water-bearing gravel at 28 feet. Three feet of fourth 8-feet section is above the ground, and the pump in it.

No. 15.—Position so designated on the map, near Broad street, west side, in the angle of the two draining ditches, 33 yards from the back channel. Four feet of the same soil as specimen No. 40.

No. 16.—Position so designated on the map. A well bored 85 feet in December, 1851, to a water-bearing stratum of white sand. I have examined the original bills, and the person who made the recent borings under my direction was engaged upon that well. Gravel was reported at 28 feet from the surface, and 6 feet in thickness, followed by "bar sand." In boring No. 2, 1864, I struck the gravel and boulder stratum at 21 feet, bored through 8 feet of it, and then about 3 feet into the coarse grit sand. The borings may be accepted as corroborative.

Boring of 1862.—The positions of the borings made by the Navy Yard Commission in 1862 are given upon the map.

No. 1, 1862, is 67 feet from the outer corner of the embankment at the southwest corner of the island at the confluence of the Delaware and Schuylkill rivers. It is about 8 feet from the principal draining ditch, and in the angle thereof.

No. 2, 1862, is 15 feet east of No. 4, 1864.

No. 3, 1862. The specimen No. 41 I dug within 6 feet of this boring, at a depth of 32 inches from the surface. It is fine sand and clay laminated; the former predominating.

No. 42 is part of the same specimen washed. It yields 431 grains fine sand, and 62 grains dry clayey matter with some sand.

No. 17.—At the point so designated on the map, 884 yards from the northwest part of the island, a gravel bank of about twenty feet elevation was examined, with the following results obtained by digging: Surface to 1 foot—1 foot of gravel and yellow clayey soil; 1 foot to $3\frac{3}{4}$—$2\frac{3}{4}$ feet of coarse gravel and boulders; $3\frac{3}{4}$ to $7\frac{1}{4}$—$3\frac{1}{2}$ feet coarse sand and pebbles, water-bearing. The sand and gravel are the same as yielded by the borings on the island; so are the sand and gravel of Red Bank, which is forty-seven feet above mean low water.

The stone wall around the island is about 13,485 feet long, or nearly $2\frac{1}{2}$ mines from the point A round by the southwest and north to B. The builder of it informed me that he laid the greater part of it just on the surface. In only one place have I seen the least signs of its having settled, and then only for a few yards in extent, and to a depth of about four to six inches. The top of it, by the levellings of 1862, averages $4\frac{1}{2}$ feet above mean high water.

There are growing upon the island within the embankment eight fine oaks, five maples, eight ash, and sixteen button balls, with possibly one or two hundred large willows. I made measurements of some of the trees, taken indiscriminately, with the following results: Circumference of oaks, four feet above the ground, $12\frac{3}{4}$, $13\frac{3}{4}$, $13\frac{3}{4}$, 16, $18\frac{1}{2}$, $13\frac{1}{2}$, 13 feet; circumference of ash, four feet above the ground, $10\frac{3}{4}$, $9\frac{3}{4}$, 10 feet; circumference of button balls, four feet above the ground, $8\frac{1}{4}$, $4\frac{1}{2}$, $7\frac{3}{5}$, $10\frac{4}{5}$, feet; circumference of maple, four feet above the ground, $11\frac{1}{4}$ feet.

I cut into one of the oaks to determine approximately its age by the rings, and estimated it 162 years old. At the same rate of growth the largest oak would be 192 years.

Attention was directed to the system of drainage of the island, which averages 3.6 feet above mean low water. It has been badly arranged; there are only three small and insufficient sluices at present available for the whole island, which is high enough for thorough drainage. The draining ditches have not been systematically cleaned out, and deposits of black mud has been formed in about half of them. This mud is easily penetrated with a rod, but when the first foot in depth is removed, the ditchers stand upon the lower part without sinking more than an inch. When dry this mud is hard. The digging in the ditches extends to a depth of about four feet when the sand is reached.

There are upon the island seven houses for residences, some with stone foundations; several large barns, and about twenty cow-houses, out-buildings, &c. The stacks of chimneys for the houses are built directly upon the surface of the soil, and even the oldest is in good condition. On the 22d, 23d, and 24th of February, I had a good opportunity of witnessing the action of the ice then in the river. On the ebb tide it was thrown by the Horseshoe towards the Jersey side of the channel, whilst that on the League Island side was very little disturbed. The large can bouys placed on the League Island shore, between Broad Street and the Horseshoe, had remained there during the entire winter without damage. An examination of the end of the wharf at the foot

of Broad Street, extending to the four-fathom line at low water, shows that the ice of the last ten years has not injured it.

During the above days tugs were towing vessels up and down the river with no impediment from the Horseshoe down. Above that I could not judge.

CONCLUSIONS.

The borings and examinations which I have this day finished, and have herein described, establish the following conclusions:

1. That the surface soil averages about three and a-half feet in thickness over the whole island; that it is a stiff, yellowish, clayey material, easily cut when wet, and very hard when dry.

2. That beneath this surface soil there is a stratum of very fine sand, laminated in places with dark clayey matter. Where this lamination exists there is an average of twelve layers of each to the inch. This fine sand stratum reaches an average depth of about twenty-five or twenty-six feet over two-thirds of the embanked part of the island. At the extreme eastern and narrow end of the island it is about forty-five feet in thickness.

This stratum is not water bearing, although water is formed near the surface, under the clayey soil. It is damp and compact.

3. That beneath the fine sand stratum lies the coarse sand, gravel, and boulder stratum, which was passed through at No 2 to the coarse sand stratum.

4. That with such material it is not necessary to use any piling for such machine shops and machinery as abound in Philadelphia, nor for machine shops or buildings of the heaviest description. That proper foundations may be laid, on an average, about six feet below the surface of the fine sand stratum. That for the heaviest trip-hammers, for the heaviest trains of rolls, and for launching-ways, it may be necessary to drive piling to the stratum of sand, gravel, and boulders. This opinion, in my mind, amounts to conviction.

Very respectfully, yours,

GEORGE DAVIDSON,

Assistant United States Coast Survey.

Professor A. D. BACHE,

Superintendent U. S. Coast Survey, Washington, D. C.